

May 14, 1962

Aviation Week & Space Technology

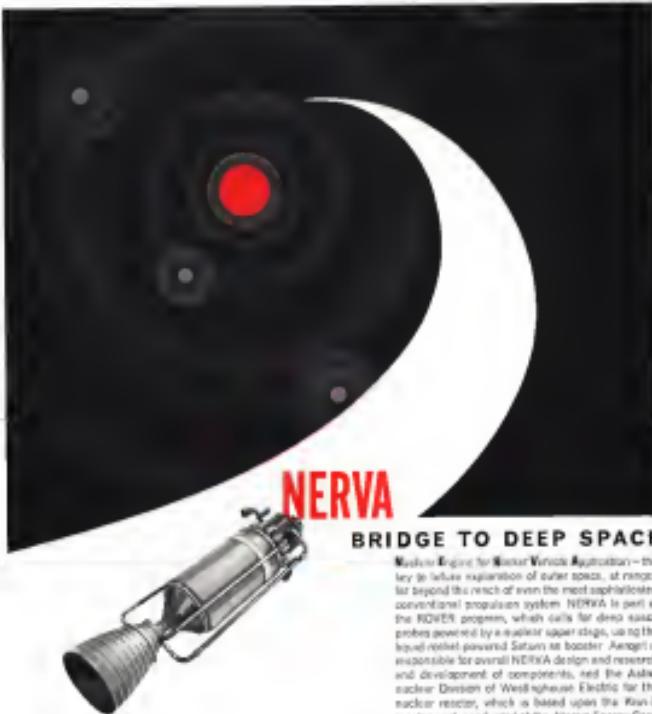
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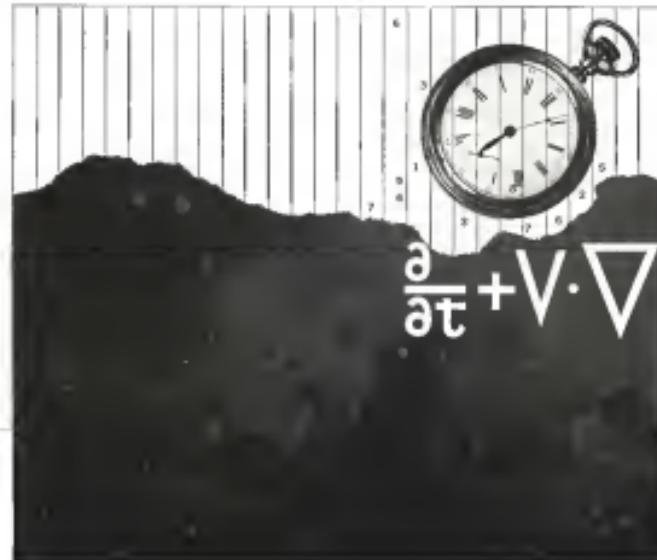


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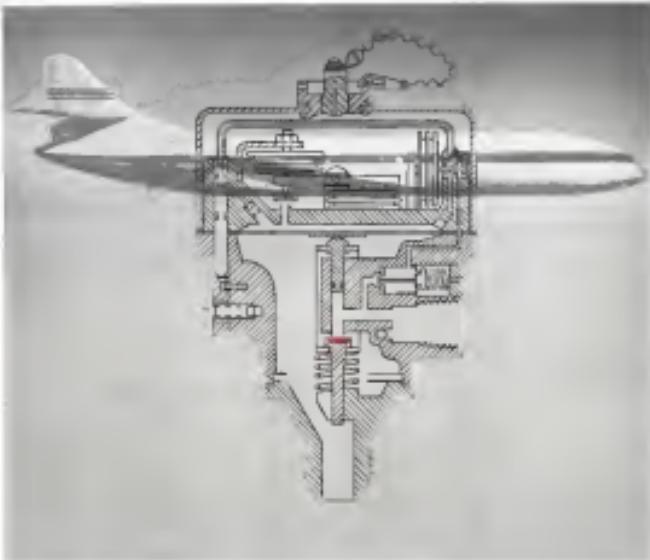


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AEROSPACE CALENDAR

(Continued from page 5)

June 4-7-1962 Nuclear Congress, St. Louis, Missouri, and Vicksburg, Mississippi.

June 5-6-7-8-9-10 Standards for Filament Wound Reinforced Plastic, Nord-Ostendorf Laboratory, White Oak, Md.

June 6-8-9-10 Annual Radar Symposium (Sponsored jointly, Institute of Sensors and Telemetry, Research Laboratory, University of Michigan, Ann Arbor, Michigan).

June 7-8-9-10 Northern Metal Casters Reception, Phoenix Hotel, Salt Lake City, Utah.

June 8-9-10-11 National Maintenance and Operation Meeting, Reading Aviation Service School, Reading, Pa.

June 11-12-13 National Conference, National Aviation Education Council, Seattle, Washington.

June 13-14-15 Annual Meeting, West Virginia and Paul Marquette Institute, University of Washington Seattle, Wash.

June 17-18-19-20-21 Meeting, American Institute of Electrical Engineers, Denver Union Hotel, Denver, Colo.

June 18-19-Vacuum Metallurgy Conference, American Vacuum Society, New York University, New York, N. Y.

June 19-20-21-Advanced Subject Meeting, Institute of Nuclear Reactor Protection, University of Florida, Gainesville, Fla.

June 19-21-23-25 Meeting, Aviation Distributors and Manufacturers Assn., W. T. Harper Hotel, Los Angeles.

June 19-22-23-24 Meeting, Institute of the Aerospace Sciences, Ambassador Hotel, Los Angeles, Calif.

June 20-22-Annual Convention, Airline Ground Transportation Assn., Bayard Hotel, New York, N. Y.

June 24-25-Annual Meeting, American Society for Testing and Materials, St. Louis Hotel, St. Louis, Mo., June 25-26.

June 21-22-23-24 National Convention on Military Electronics, Institute of Radio Engineers, Monrovia Hotel, Washington.

June 25-26-Symposium on Electromagnetic Theory & Applications, Copenhagen, Denmark. Sponsored Technical University of Denmark, International Scientific Radio Union.

June 26-28-International Conference, American Society of Mechanical Engineers, University of Maryland, College Park, Md.

June 28-29-30-31 National Meeting, American Meteorological Soc., University of Colorado, Boulder, Colo.

June 29-30-31-3-4 International Conference on Radiation and Data Processing, W. M. Keck Laboratory, University of Southern California, Los Angeles.

June 30-July 1-2-3-4-5 International Conference on Refined Coal Dynamics, University of Paris, Paris, France. Sponsored AFOSR, NASA, ONR, NASA (Open meeting).

June 27-28-29-30-31-30 Symposium on Control and Data Processing, W. M. Keck Laboratory, University of Southern California, Los Angeles.

June 31-July 1-2-3-4-5 International Conference on Radiation and Data Processing, W. M. Keck Laboratory, University of Southern California, Los Angeles.

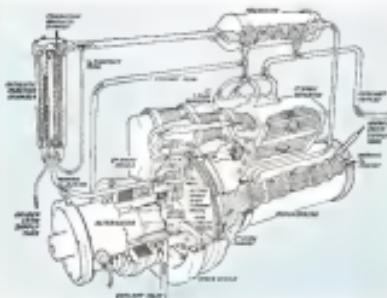
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July 7-11-15th Annual All Women's Train-

(Continued on page 9)



A SENSIBLE WAY TO PROVIDE ACCESSORY POWER IN SPACE VEHICLES

This is the Sundstrand CRYTHOCYCLE...a synergistically fueled, fully integrated power generation and thermal control system. Sundstrand developed the turbine driven CRYTHOCYCLE

under a U.S. Air Force Systems Command contract. Powered by hydrogen and oxygen, the CRYTHOCYCLE is unique in that normally wasted heat from energy conversion inefficiencies and excess metabolic heat from the crew is harvested to cover the cockpit heat and returned to the power cycle by heat-to-heat recuperators

between each of the four stages of a single-disc iteration. Sundstrand has also developed a multi-stage recuperating version of the CRYTHOCYCLE for low power levels. This unique

results in specific fuel consumption economy which has not been achieved by any other dynamic space power system. As a result fuel weight and volume are reduced. In addition, the CRYTHOCYCLE operates at room temperature eliminating need for high temperature insulation, sealing wheel replacement problems, and greatly improving overall reliability and safety. Since the CRYTHOCYCLE is independent of the environment, it is ideal for Lunar missions.

The CRYTHOCYCLE is a sensible size, too. About the size of a gasoline lawnmower motor, it can be used in pairs for microelectronics. ■ Several versions of this space power system are being developed which will be suitable for missions of several weeks' duration...at power levels from one kilowatt to 50 kilowatts. Both the turbine prime mover (turbo) and the recuperating machine have been publicly demonstrated to representatives of the aerospace industry and government services. ■ (A single request for price, technical statement and we will send you details concerning this and the other accessory space power systems which Sundstrand has under development.) ■ If you would like to work on the Sundstrand CRYTHOCYCLE part in the development of practical solutions to challenging space power problems, write to: Personnel Director.



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AEROSPACE CALENDAR

(Continued from page 7)

continued. An Rv from Ordnance Coll. in Washington, D.C.
 July 12-15—12th General Assembly, NTID's Aeronautics Group for Aeronautical Research and Development, Paris, France
 July 17-19—Latin American Meeting, American Institute of Aeronautics, Pick Conference and Hotel in Duluth, Minnesota, U.S.A.
 July 24-Aug. 2—National Inventory Disposition Dept., El Monte, Calif. For information: National Surveyor Disposition, P.O. Box 917, Yorba Linda, Calif.
 Aug. 5-16—29th Standards Laboratory Conference, National Bureau of Standards, Boulder, Colorado.
 Aug. 19-21—Meeting of Marshall University's Air and Space Institute of the Aerospace Studies Disposal Hotel, Seattle, Wash.
 Aug. 23-26—Frigidaire Energy Conservation Conference, Fairmont Hotel, San Francisco
 Aug. 24—Organization of Manufacturing Center and University of California at Los Angeles, Los Angeles, Calif.
 Aug. 18-19—National Propulsion Conference, Monterey, Calif. Joint Meeting: Institute of the Aerospace Sciences American Astronautics Society, American Mechanics Association.
 Aug. 25-26—Annual Meeting and Conference, Airport Operators Council, Phoenix Hotel, Las Vegas, Nevada, Hawaii
 Aug. 28-29—Women Electronics Show and Conference, Institute of Radio Engineers, Los Angeles, Calif.
 Aug. 31-Sept. 1—17th Session, Internationale Union of Air Transport Organizations, Amsterdam, Netherlands
 Aug. 23-26—Quarterly Regional Meeting, Van of Local Transport Agents, Wiesbaden Hotel, Wiesbaden, W. Germany
 Aug. 27-29—Symposium on Ballistic Missiles, Fairmont Hotel, San Francisco, Calif.
 Sept. 1-4—Los Angeles Calif. Sportsmen's Club, Los Angeles, Calif. Sponsor: U.S. Air Force, Aerospace Corp.
 Aug. 27-Sept. 1—Third International Congress of Instrumental Control of the Aeronautical Sciences, New Congress Hall, Washington, D.C.
 Sept. 3-6—1967 U.S. Dept. of Defense and British Air Forces of Britain Aircraft Conference, Farnborough, England
 Sept. 10-14—Annual General Meeting, International Air Transport Ass., Dublin
 Sept. 17-18—International & Air Control Vt. Trade Meeting Institute of the Aerospace Sciences, Washington, D.C.
 Sept. 18-21—1967 National Convention & Aerospace Products, Air Force Ass., Las Vegas, Nev.
 Sept. 19-22—Second International Signal and Control Congress, National Science Center, Mexico City, Mexico, Mexico
 Sept. 24-25—11th International Astronautics Congress, American Rocket Society, Sofia, Bulgaria
 Oct. 29-30—Symposium on Dynamics of Manned Orbiting Planetary Entries, Florida Institute of Technology, Melbourne, Fla. For information: Institute of Space and Rocket Engineers Room 1102A, General Electric Co., MWTD, Valley Forge Space Technology Center, Box 1117, Philadelphia 1, Pa. Co-organizer: AFOSR



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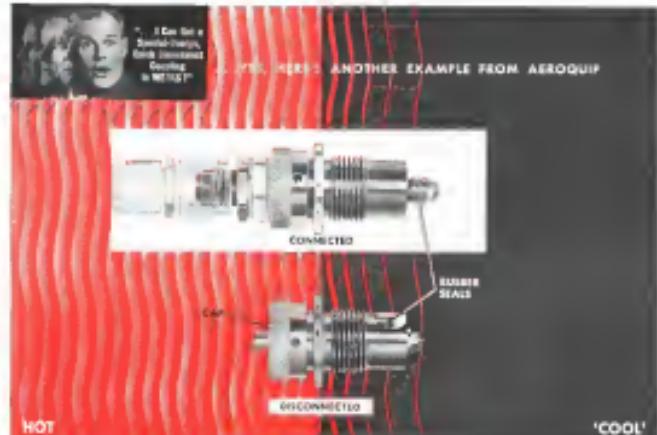
Problem for Skybolt: Where is this patch of sky?

To calculate its trajectory to target, Skybolt air-launched ballistic missile will have to know precisely where it is at any given moment, day or night. This problem is easily solved by the star tracking capability of an auto-oriental guidance system, which can provide an instantaneous fix on any piece of sky the mother plane passes through. When Skybolt is operational, the guidance system will put

it onto a ballistic trajectory after launch, to deliver the warhead on target up to 1000 miles away.

This versatile star-infrared inertial guidance system is being developed for the USAF-Douglas Skybolt by the Northrop Division of Northrop.

NORTHROP



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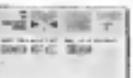
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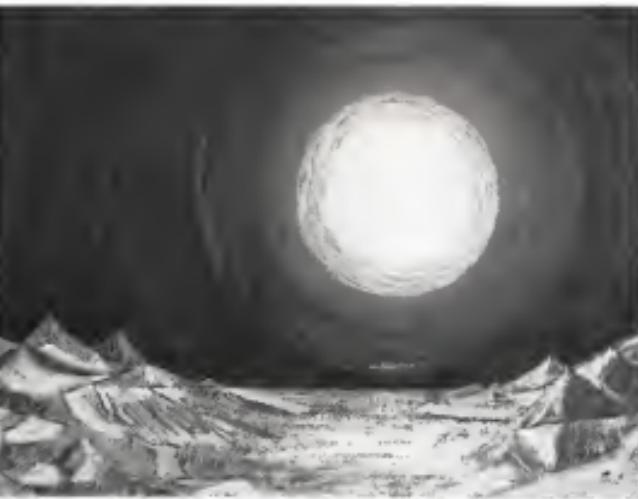
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Scientific prediction indicates that solar activity will be at a minimum between July, 1964 and July, 1965. This has been designated as the International Year of the Quiet Sun, and during it a world-wide magnetic survey will take place. □ The Douglas Space Physics and Planetary Sciences Group is studying scientific experiments to be performed on satellites and space probe missions during this period. Instruments to be used will be among the following: magnetometers; ionization chambers, G-M detectors, scintillators, solid state detectors, and spectrometers. □ The present Douglas Astrotec Research Station program for the study of cosmic rays will continue through this "Quiet Sun" period and will provide important data relative to solar cosmic ray and auroral events and the geomagnetic. □ Koenig Douglas was invited to participate with the National Science Foundation in this program.



Preparation for the Year of the Quiet Sun world scientific survey is one of more than 500 research projects that are under way at Douglas. Some of these relate to the initiation of problems on programs of today and tomorrow. Others might though development and research programs whose effects may not be evident until ten or twenty years in the future.

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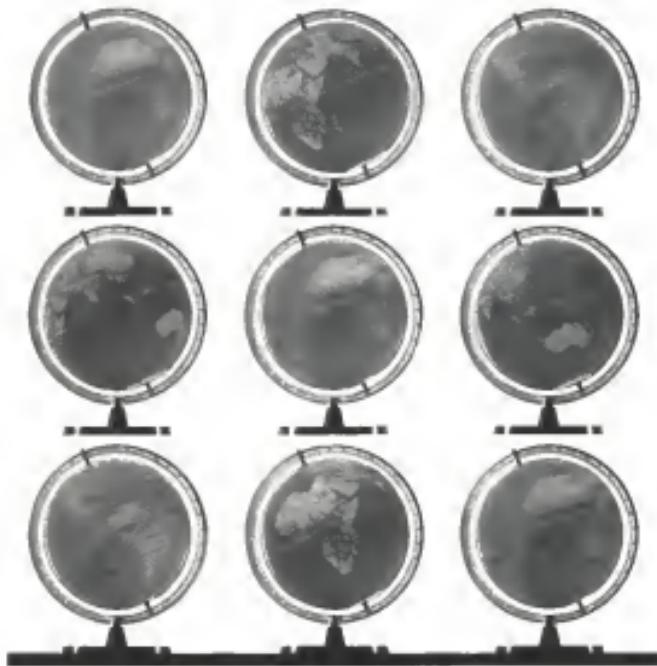
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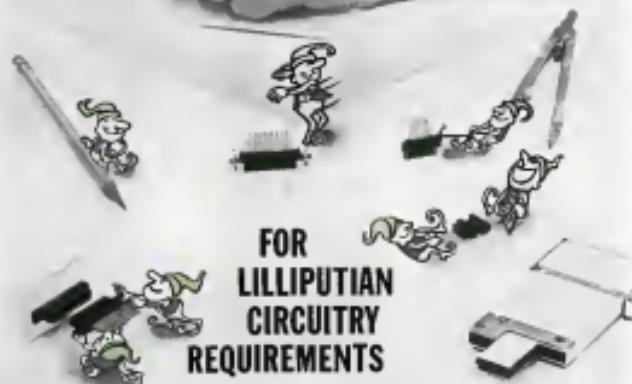


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EDITORIAL

Changing Climate for Management

(Background for the current stress on weapon system management, which was the subject of a top-level industry and Air Force Systems Command meeting at MacDill Air Force Base, Fla., was summarized there by Lt. Gen. Howell M. Davis, Jr., deputy AFSC commander for aerospace and test. Significance of the following is his summary below.)

Because of the continuing and explosive growth in our scientific and technical know-how, the alternatives open to us in system design and configuration are stag- gering in number. The same applies to the solutions of technical problems within a specific system program. The choices here are such that there is seldom a single answer of, from the technical standpoint alone, even a single best answer. The process of final selection from among that myriad of possible alternatives has therefore become exceedingly difficult, while the necessity to arrive at the solution most appropriate to existing and future circumstances has become ever more urgent. These conditions have demanded:

- **First**—that a capability be developed within the management structure to assess continuously the growing state-of-the-art across many fields of technical interest in order that all available alternatives to technical problem solution may be taken into consideration.

- **Second**—that the decision-making process be so arranged as to ensure the most complete examination and study feasible of all possible alternatives, and that sound, mature and enlightened judgment be applied in the selection from among them of the course of action.

- **Third**—that management, at all levels, to a far greater extent than ever before, be informed in depth and breadth so as to be instantly and effectively responsive to decision-making needs.

In former days, we organized various levels of management to establish a workable span of control for each echelon and also to permit decisions to be made where the facts were available. Relatively speaking, the information passed to top management consisted of an integration of the many considerations resolved at each level as a recommendation moved upward. In the military, this was known as "completed staff work."

In today's complex problems, all of the facts which must be taken into account are certainly not at the lowest levels. Rapid final decision-making has become essential. The new techniques can make the same information available to top and bottom management at the same instant. In effect, then, a wider span of control can be officially handled by one manager, and top management can participate more directly in the several levels of the decision-making process.

This means that modernization of older and more conventional management structures can and should be effected so as to insights and make more direct our decision-making channels.

Whatever may be the organization structure adopted, maximum efficiency cannot be achieved unless today's data-handling capabilities are properly used by management. Too much information at the top can be as self-deluding as too little. We can see that top management will be presented with a flood of data arising from a flow of analysis. It is also possible that an over-

continuation of control and direction might result, in which lower level analysis or author responsibility are required. From my own operational experience, I can recall prior higher level decisions which would instead have been practical and the opposite of any crew chief being caught unprepared.

Information processing capabilities of today have thus generated a need for a new and critical look at management techniques, procedures and structure in order to reduce unwanted overhead and to realize the true potential increases in efficiency which are offered.

There are no easy or unanticipated answers to the hyperactive and hyper-declarative thermometer-like defense/Space age. Several strategies are available of systems whose total cost has gone through the roof: operational deployment is more than the total military budget of not many years ago. As compared with the hundreds of thousands of dollars which might have been accepted by a 1955 user in the total cost of the system of several years ago, a similar saving today could amount to hundreds of millions. Costs are of such proportion today that the consequence of a single error in decision or in the selection of those among the several alternatives could be an enormous variation in dollar resources required.

The same is true at regard system complexity. In many of the systems of today and of the future, there is an extremely thin line between efficient performance and dismal failure.

As Gen. (Bernard A.) Schriener (AFSC Commander) stated so emphatically in his opening remarks, this places a premium today on thorough cost analysis, sound cost estimation and firm cost control. Financial resources must provide the ready accessibility which will permit our integration between projects and major elements of projects and which will foster cost accurate later summations at frequent intervals. I do not know of any management area which needs more attention in the future than this one.

.... The advances of science and technology now permit us to accomplish many of our military objectives by what might be called technical finesse rather than by weight of numbers. Management structures which were configured to high volume production of systems developed from a relatively well understood technical art and fabricated by long practiced techniques will not meet the demands of the future. We must structure ourselves for lengthy development periods based on newly emerging technologies. As Dr. [John S.] Foster (director of Lawrence Radiation Laboratory) said yesterday, we must reach out into the slightly radical, yet have within our management capabilities the checks and balances to prevent us from reaching too far. Provenance requires most accurate methods and controls which are graded by new and increasingly demanding standards in the areas of close tolerances and super high reliability. Since that change in the nature of our future systems is one of the most obvious causes for management change, I will not dwell on it. Let me emphasize, however, that the significance will be even more apparent as we progress further into our space programs.

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WHO'S WHERE

In the Front Office

William B. Baker, executive vice president, Lockheed Aircraft International, Los Angeles, Calif.

Robert J. Marano, assistant vice president, defense marketing, General Precision Inc., Torrance, Calif. N.Y.

Edward W. Johnson, president, Loral Communications, North American Aviation's Rockwell's Reliant Motion Division and Unifit Technology. Also intended to be used with Titan 2 alone as some space missions under the Titan 2 program, the stage will use the same propellants as Titan 2. Stage will have two gimbaled motors with pressure-fed propellants. It has a capability of multiple starts and deploys about 16,000 lb. thrust total. Martin's Defense division will serve as various integrators in meeting the government-formulated transfer stage with Titan 2 core.

Edward W. Falter, vice president/operations, Chicago Avionics Industries Inc., Basington, Ill., succeeded Wayne R. Johnson, who recently retired.

Reginald L. McKenna, vice president and general manager, Aerospace Control Corp., Arleta, Calif.

James C. Callahan, a vice president, Rockwell International, Los Angeles, Calif. Mr. Callahan is also a general manager of the Technical Products Division.

E. Douglas Gubler, vice president/operations, Thermo-Nordex Division of Loral, Inc., Electronics Inc., Boston, Mass.

Edward M. O'Brien, Weybridge, U.K., representative for Farnsfield Systems Corp., Farnsfield, U.K., succeeded John C. D. Parker, president of Link Corp., Vicksburg, Mississippi as a director of Farnsfield.

Honors and Elections

The following awards for 1965 have been announced by the American Electronics Society's first Icarus-Kennedy International Trophy, presented by United Aircraft Corp. for the best achievement in the field of electronic applications of the technology of Dr. Michael J. MA, Soviet hydrophone designer, the Dr. Alexander Kostylev Award, for notable achievement in the advancement of marine sonar acoustics to Eng. Gen. Robert W. Wilkins, commanding U.S. Air Force Air Warfare Center, Edwards AFB, Calif. The Capt. W. E. J. Reader Award for the advancement in aircraft applications or operations of rotary wing aircraft, to the Air Rescue Service of the Air Mobility Air Transport Service, the Frederick L. Panchuk Award for the general high level of achievement in the field of aircraft applications of the technology of Capt. W. E. Col. Ernest M. Crampton, manager, NASA Flying Training Support Directorate, Wright AFB, Ohio, the General E. Bell Award, for outstanding work in the development of military aircraft, the most recent award for the advancement of rotary wing acoustics was presented to Ed Gen. Houston H. House, USAF, and Dan Ross Macklin, director of the Vertical Lift Aircraft Council of the Aerospace Industries Assn. The following received Federation Aerospace Industries awards for the advancement of aircraft applications and design: Col. Col. Gen. USAF for aircraft and missile design Capt. Bruce E. Sharp, USAF, for speed; Capt. Peter J. Sloboda, USAF, for a new three-limbous model; Lt. Robert Gribble, USAF, for a new 137-21-lm model.

(Continued on page 317)

INDUSTRY OBSERVER

► Proposals for Air Force Strategic Communications Space Systems Division competition for additional transfer stages to be used with Titan 2 core of Titan 3 configuration were submitted last week by Aerospace-General, Bell Aerospace, North American Aviation's Rockwell's Reliant Motion Division and Unifit Technology. Also intended to be used with Titan 2 alone as some space missions under the Titan 2 program, the stage will use the same propellants as Titan 2. Stage will have two gimbaled motors with pressure-fed propellants. It has a capability of multiple starts and deploys about 16,000 lb. thrust total. Martin's Defense division will serve as various integrators in meeting the government-formulated transfer stage with Titan 2 core.

► Revised schedule for Bell System Telstar active-recommencement satellite for launch June 26. Slight schedule change is due to delay in completion of the satellite. If launch is not successful, a backup satellite is expected to be scheduled for launch two months later.

► First major advancement of the Lockheed C-141 cargo transport—the first stage of the first inspection scheduled to be completed by July. The C-141 program, which is to cost \$1.2 billion to \$1.5 billion, instead of the \$1.1 billion programmed, will have 40% of the dollars going to subcontractor and another 20% to improve government-financed equipment. Fiscal 1968 budget request is \$6.5 billion net for the program.

► USAF is in early stages of formulating a master plan for command and control, internally called ACE (Aerospace Control Environment). Department of Defense has not yet approved development of the system.

► Navy evaluation committee to select contractors to develop an early model for its version of the F/A-18 fighter apparently has narrowed the field of four bidders in two: Hughes Aircraft and Raytheon (AWW Apr. 3, p. 11).

► Lockheed Missiles and Space Co. and Ford's Aerospace Division have been selected from a group of eight competitors by NASA's Marshall Space Flight Center in previous successfully studies of earth-Mars-Venus mission mission profile specifically designated Engine-Only Mars-Pioneer Interplanetary Boundary Exploration (AWW Apr. 3, p. 90).

► West German government apparently is interested in the strong West German Bf-109 jet fighter-bomber built under license in Germany. Engle has potential thrust of 10,000 lb. (AWW Apr. 23, p. 99) and will be principal proponent for Fokker-Wulf F-104 light-weight fighter.

► USAF's Electronic Systems Division is introducing a new standard cost format for use by acquisition making proposals, as part of a USAF effort to improve cost estimating. Format breaks the program into development phases and provides for detailed delineation of costs for labor, materials, etc., in each category. Now being applied to new ESD contract out of a total of 14, the format was begun for programs funded in the Fiscal 1967 budget.

► USAF's proposed flight test program for Titan 3 was designated as 624A stratospheric space-launch system, calls for 17 vehicles, six of them Titan 2 cores and the test complete 120-mile boosters comprising a Titan 3 core with two 120-in. solid propellant boosters strapped to its sides. Total program costs are estimated at \$1 billion.

► Raff (Racine la-Flight Test) stage development contract award by NASA is expected this week. Paul Silders, an General Dynamics/Aerospace, Lockheed Missiles and Space Co., and Martin's Avionics General will develop the propulsive, Westinghouse will develop the nozzle.

► Decision is imminent in AFSC's Ballistic Systems Division competition for boost vehicles to be used in conjunction with polarization code program. Selection of contractor will be made from group including Atlantic Research Corp., Aerospace-General, Aerofit Development Co., Long-Term Veight, Martin, Ford's Aerospace Division and Hughes.



GUIDANCE COMPUTER for NASA'S CENTAUR

Sometime this year, CENTAUR will be spaceborn. Already, the projected uses of CENTAUR bear fascinating implications for the future... placing a satellite in an orbit so exacting that it will remain in one spot over the earth's surface...soft landings on lunar and planetary bodies...timed launches of several satellites from a single vehicle. Several major guidance functions will be performed in CENTAUR by a compact digital computer system from Librascope. It weighs 62 pounds, occupies little more than $\frac{1}{2}$ cubic foot. A note to Librascope: solving your control problems will bring a prompt answer from the country's most versatile manufacturer of computer control systems.

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New Patent Interest

Washington Roundup

Kennedy Administration is showing mixed interest in developing a national patent policy for inventions made under government contracts. Jerome Weisner, president science advisor, is heading the first White House effort to find a common ground between the patent policies of the Defense Department and the National Aeronautics and Space Administration.

Defense officials feel the engineers take risks so inventors while NASA scientists take only risks as provided procedure. Copyright is split on the issue and probably will not resolve it this year without White House leadership. One group contends invention should be considered part of the contract when the government signs research contracts, while another faction argues such a policy discourages contractors from disclosing inventions or even accepting the work in the first place. A House space subcommittee recently recommended giving the NASA administrator more flexibility to decide whether the government or the contractor should take risks in inventions (EW Apr 25 p. 30).

President Kennedy last week said he will recommend patent legislation to Congress if it cannot agree on standards during the session. He will work on a uniform patent policy. "It's difficult to have one here to balance all the interests on the one hand and at the same time, the incentive to companies to spend their own funds in order to develop patents which would give them a return in other areas."

House Centaur Probe

House Space Sciences Subcommittee is in investigation of the Centaur program, intends to call in Werner Von Braun, Marshall Space Flight Center director, and Dr. Elmer Novell, NASA Office of Space Sciences director, as well as industry officials representing General Dynamics, Thiokol and Pratt & Whitney.

Chairman Joseph Knobell told Aviation Week that after the inquiry, tentatively slated to start May 15, his subcommittee will issue an evaluation of the management of the Centaur program. He feels his subcommittee did not get a full explanation for Centaur delays during a subcommittee hearing. Chairman George Miller of the panel House space committee, is somewhat less intent on investigating the Centaur probe, feels it would have been held off until space agency's report on Centaur's failure (EW p. 36) was submitted.

Senate Personnel Investigating Subcommittee is preparing profit hearings May 15 with officials of General Dynamics/Thiokol and Thiokol, Boeing Co. and Boeing subcontractor Bell Helicopter. Meanwhile, the Budget Bureau is studying reduced cost allowances to Atomic Energy Commission, Defense and NASA contracts. Project is under William Armstrong, Budget Bureau's financial management chief.

Communication satellite legislation is expected to be approved by the Senate commerce committee May 16 substantially in the form it passed the House (EW Apr. 7 p. 20).

Live Warhead Launch

Nuclear testing plans include the firing of an Atlas intercontinental ballistic missile armed with a nuclear warhead from Vandenberg AFB, Calif., to the Pacific target area. Administration and Defense officials feel the risk to peace for the warhead outweighs the risk of the Atlas exploding during launch or in flight and damaging surrounding communities. The nuclear warhead itself is arranged so it would not explode in such an event. Although Vandenberg is on the coast and not far west of Los Angeles, the missile trajectory will take the Atlas over more populated areas.

Aerospace Industrial Assn. is looking for a president to replace August C. Finsen, who resigned effective May 15 because of mounting charges financial condition at Gen. William Smith, Everett (Wash.), a former USM director, chief of staff for president, has joined AIA's staff. He will oversee the AIA's West Coast activities at first but eventually may direct them.

Van Allen Belt Study

President Kennedy has ordered a study to determine whether the USO to allow high nuclear explosion planned during the current U.S. test series would create some effects in the Van Allen belt in a way which would adversely affect scientific discoveries. Dr. James Van Allen, who discovered the belt, has called the proposed high altitude test a "magical experiment" but other scientists have expressed fears the belt might be damaged in the blast.

Committee on Space Research (Cospar), on the closing day of its meeting last week, decided to form a committee to examine such controversial experiments. The committee is called Committee Group on Potentially Hazardous Effects of Space Experiments but its members have not been named.

—Washington Staff

unannounced visit, as is future to allot sufficient funds to cover the contract and the use of fund withholding as a possible measure.

• Report simplification: As a condition to the completion of these funds, there was also complaint about their complexity, and adoption of simplified and simplified formats was recommended. In addition, two legislative changes were recommended. One would assist the DOD budget to determine program costs and another legislation would assist the Department of Defense in its efforts to acquire from the defense industry. Irving Roth, a special financial advisor to the Undersecretary of Defense and chairman of the Comptroller's panel, also reported. The group's recommendation for a complete overhaul of the Armed Services Procurement Regulation and the Armed Forces Procurement Act of 1947. More reports are required under one or the other, that are now combined, and an overhaul of the structure that has grown up since such was adopted as desirable by me.

• Subcontracting: "Militia or buy" negotiations or requirements to obtain subcontractors were demonstrated frequently at the working group. Industry felt it is required to growth and expand and was asked to submit a memorandum USAF funds industry does not adequately understand its rights and regulations. It also complained that it has been forced into subcontractor management rather than to develop its own management function. This area Comptroller group recommended the responsibility of procurement and contractors in subcontracting be defined with greater clarity and that person be given full responsibility for subcontract procurement, with incentive payments provided to subcontractors for quality. This recommendation only included work of the working group that had performed in the past was encouraged, for application of this rule to an logical conclusion in the past would have meant that none of the companies now in the defense business could have gone into that area. Reasonable limits to the price for subcontract supervision was endorsed.

• Construction regulation: Industry, DOD, government contract and management associated with logistics, acquisition, research, administration—some areas used as a catch in lieu of good acquisition agreement. Defense Research & Engineering, acquisition, and construction, as outlined by Robert F. Horner, senior vice president of Northrop Space, Lab operations and conclusion of Comptroller's report. Work in large staff, Horner said, DOD/DoD has to follow the trend tendency to reverse its authority in management in all with technical areas. Total cost and management costs between the group and

the various departments and the Office of the Secretary of Defense should resolve the problem, he added. Comptroller reported agreement on the group that separation of management offices were not believed cost. "I am not arguing against the policy of separation," he added. "But there is a human tendency to take on too much detail at top level under the circumstances."

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Microcircuit Production Expected To Reach \$1 Billion in Next Decade

Washington—Production of microcircuit and all types is expected to total \$1 billion per year by 1975, but will require more than 15% of the total estimated \$6 billion semiconductor market. The National Electronic Components Conference, held last fall in Las Vegas, told the group. System Command would do something about one of the recommendations which fell within its authority.

• Microcircuit Production: Spangis said the predictions, centered around a "head long rush" into microcircuits and short circuiting efforts to develop new and improved conventional components. Spangis is chairman of Spangis Electric Co., one of the country's largest producers of components.

Spangis recommended that the U.S. will probably maintain the rate in the next years of all varieties, including microcircuits, short-circuited, something which equipment designers are reluctant to accept.

Spangis predicted that conventional package materials using discrete components will be the first to find wide spread use, followed by planar integrated microcircuits and later by multichip hermetically sealed packages. However, he predicted that "all these approaches will develop along parallel lines and will coexist rather than supplant one another."

These and some other predictions are not shared by all segments of the electronics industry, with components being the most common design by the industry's leaders, but not necessarily the others. Other views of the trends in microcircuit technology are reported in the news items on pages 14 and 15 of this issue.

Spangis concluded with the following

U.S. Data Policy Impresses Symposium

By Edward H. Kolman

Washington—U.S. policy of free exchange of scientific information on its space flight programs impressed the world scientific community meeting which ended last week while in Moscow. The Soviet Union preferred to its characteristic aggressiveness and suspicion a more generous, broad-based spirit of its own space hardware and developments.

Severi Commissar Gherman Titov exhibited an ability for eloquence during frequent public appearances in connection with the Third International Space Systems Symposium, but he failed to provide any new information about his flight except to confirm that he experienced a modest weightlessness. The comparison between the detailed, model approach of U.S. Astronaut John H. Glenn, Jr., and that of Maj. Titov (see the full report of Maj. Titov's flight, p. 47) was obvious to delegations from 70 nations attending the symposium.

Titov also frequently related scientific cooperation in space and disarmament as the two main policy areas of the USSR.

Titov's description of his fourth vehicle-size liquid propellant engine with a total thrust of 1.3 million pounds impressed new information to most U.S. observers, but actually was the same description given last fall in his class for space and orbital flight design students to Federation Aerospace Internationals.

It was apparent that delegations to the symposium, sponsored by the Committee on Space Research (COSPAR) of the International Council of Scientific Unions, were most interested in Titov's motion sickness (AWW May 7, p. 38), which was discussed shortly after his 2½-hour space flight last August, and the Russian's own efforts to find a study of the effects of prolonged weightlessness has top priority in planned space flight research efforts.

Titov and his colleagues "may be a paradox of my own organization," [which results in] not getting space flight sufficiently high," he told Dr. Hugh L. Dryden, deputy administrator of the National Aeronautics and Space Administration, and Space Administrator, that he feels no special stage is required to reflect any physical gravity area within a ship per se, "when a person is in orbit."

During the "Cospar" life sciences session, Nov. 9, Capt. Arthur Gribble pointed out that any solid nucleus can be reduced by a slight rotation, while the article is affected by a combination of new gravity and angular motion. He vividly demonstrated the effects of these

rotations with a motion picture showing a champion swimming after a brief period in a rotation chamber.

Capt. Gribble is director of research at the school of aviation medicine at the U.S. Naval Aviation Medical Center, Pensacola, Fla.

Maj. Titov, who stated that his rocket did not have his name on it, was asked about his 1968 flight, not only for thermal balance and at a very slow rate. He and the Titov may be erroneous, by "fanning the name on earth."

• Gribble and he believed the solution would be found by the time man is aboard rotating space station. He explained later that possible solution to the Titov's problem is development of a drug, careful selection and training of astronauts able to withstand the rotation effects and surgical blocking of the inner ear. The surgical method is the last desirable, he said, as it could induce unwanted side effects.

MA-7 Objectives

Washington—Next Monday, Nov. 10, at 10:30 A.M. the Manned Maneuvering Unit (MA-7) will be launched from the Titov Cosmonaut Center in Star City, Russia.

Flight objectives: May 7 that the MA-7 mission will have three added objectives:

• Detailed observation and analysis of the human problems seen by both Gribble and Titov.

• Observation of the behavior of liquid—possibly liquid hydrogen—as a weight less mass. Characteristics in zero gravity of liquid hydrogen, to be used in propulsive maneuvering of orbital weightlessness.

The MA-7 capsule will have several transparent spheres containing the liquids which will be observed and photographed by Dr. Gribble.

• Maneuvering of day and night, by use of an orbital balloon based on the Gribble's report.

• Human observations, emphasizing the bone loss. There is some disagreement at this point between Gribble and Gribble (AWW April 21, p. 58).

Some studies, including testing of Gribble of the MA-7 to define the man's performance capability in space conditions, were aided by Walter C. Williams, aerospace division director of McDonnell, speaking in New York. McDonnell's performance in space is said, will be tested by having the day balloon maneuvered by multichannel gimbals. Gribble's addition will attempt to photograph Gribble's humanics particles

that refused to answer direct and questions put to him by Col. Gleissner during the Vostok 2 flight, although both space pilots and their commanders with other crews have been useful. Col. Gleissner said that the Soviet pilot can control the motion of the let the space ship fly. "This is natural," he said, "and could control it." but he did not say that he control the motion.

The U.S. pilot pointed out that he had some performance measurements—self documented in the detailed report of the flight of Friendship 7 available generally (AWW April 16, p. 36) and to Gribble and Titov if there were any indications in the Soviet program or approximate numbers in Titov's flight.

Titov and Gribble then have been "no failures in science flights in the Soviet Union." "We feel one can't hide even a smile in a handshake; everyone would find out, we would not attempt to hide," the fact that a Soviet cosmonaut had been killed.

As any problem short of total failure, he told Col. Gleissner, "we'd be glad to share them with you, but there are none." He attributed that attitude to the lack of concern to the problems of developing spacecraft "in space," which means complete safety at Soviet research space vehicles.

Throughout his stay in Washington, Maj. Titov declined to discuss the nature or characteristics of the other Soviet astronauts. Col. Gleissner, however, said the next U.S. orbital flight by Lt. Col. Scott Carpenter will be approached within a few weeks.

One ongoing concern in the Soviet reports on life sciences was an apparent though unconfirmed on Russian experiments dealing with healthiness and health factor written and presented by Dr. Valerii V. Sotin, director of the Soviet Academy of Sciences Institute of Physiology, and Dr. O. G. Gerasimov, of the Institute.

Dr. Sotin emphasized that from USSR experiments, physiological research in space flight status "are not of particular character."

A leading Soviet medical specialist in Dr. P. P. Pashin was anxious about the effects of weightlessness, and he concluded that it would be highly of interest to observe that the problem of weightlessness has not been solved.

Among the more important subjects facing untrained pilots, Capt. Gribble said, is the problem of maintaining the biological balance of the organism after a prolonged stay under zero gravity and the influence on the organism of space flight fixtures—excluding motion areas.

NATO Fighter Decision Is Due in June

By Cecil Brownlow

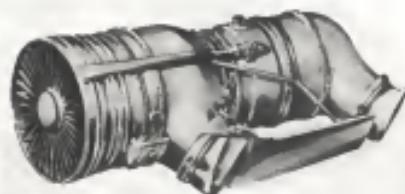
BRUSSELS—Secretary of the North Atlantic Treaty Organization is expected to issue its recommendations for a new generation fighter for member nations sometime next month, with the final decision coming later this year from the conferees of the top-level NATO Aerospace Committee. Technical subcommittee reports on the competing designs were submitted to be submitted to the committee last week.

Most industry observers attending the annual February 1 Brussels meet (p. 56, 1/27) who are directly involved with the program seem to believe the final decision, if there is one, will be a two-odd technology common and pilot cells, nothing further down the line to order production of evaluation quantities of two different type aircrafts—dependent upon part life engines for VTOL, plus/minus the other upon variable thrust propellers.

Primary Issue

Beyond the rationale and cost issues anticipated in the competition, the arguments for and against the two-life principle for combat aircraft have emerged as a primary issue in the deliberations. The two-life position, popular with manufacturers who believe it is a matter of body type, gather support from combat conditions, including divisional operations, able to produce from prepared, semi-prepared or rough air with a maximum of technical personnel and logistics and operations for variability under adverse weather conditions.

Of the four aircraft reportedly still in the competition (AWA Apr. 9, p. 26) two depend upon the part-life principle



GENERAL CONFIGURATION of the advanced British fighter FB.180 variable-thrust, canard-wing aircraft features shoulder mounting of the forward canards on the nose; variable canards extending from the forward canards operate on the nose ground principle as a conventional airbrake in controlling the fighter's yaw. During maximum thrust, forward canard mounting, the nose partially retracts over the nose cone, attitude being taken on the aircraft's fuselage during normal flight. Extension and retraction is automatic. At least three model numbers of the FB.180 are under development. The 3 version, with a thrust potential of 15,300 lb, is incorporated in the Republic F-105. The FB.180 variable-thrust design develops a thrust vector, the 9, is envisioned for the Hawker P.1184, a competitor of the D-24 in the current NATO BMR competition.

—Pratt's Dassault Sef Minge 1 V and British Aerospace Corp.'s advanced variable-thrust design and two other variable-thrust competitors—the Hawker Siddeley P.1154 and the Republic/Fokker D-24. All three, both built around variants of the British Sabre 105 100 engine.

Any decision, however, can be meaningless unless funding can be obtained on a sustainability basis for development and production. NATO is stuck in its ways for the program.

With joint air plans by France and West Germany to develop first generation BMR projects on their own, although either or both could still remain in the NATO program once the latter ceases to be the sole defense delivery system, it has been claimed by the majority VAX competitors that the U.S. is a similar fighter and be a reasonable replacement in Great Britain for a current aircraft for use by the Royal Air Force and Royal Navy.

Elsewhere decision on either project plus the resultant growth of interest funding could have an important bearing upon the final outcome of the NATO BMR 1 program.

Still another factor, largely based upon the French and West German decisions to develop their own respective aircraft designs for a long-range VTOL fighter, is the strong swing within NATO towards a high performance aircraft which has one of the world's spectrum and exclusively the greater BMR-1 specifications for a low

level slow-support aircraft. The Minge 1 V may emerge as the possible candidate as it is intended to sustain both VTOL performance plus high production rates of both aircraft.

Promised specifications call for an average rate of 200 m on the deck speed of at least Mach .92 for distances of up to 120 m, with a further stipulation that it is capable of flying 75% of its service life at sea level.

The BAC variant, the D-24, and the P.1154 all have Mach 2 plus high-altitude capabilities as the sea level performance outlined in NATO and could perform both intercept and close-support missions. The D-24 is intended in both the VAX and the AAF Royal Air Force, while the P.1154 is intended with British Aerospace Corp. claiming that the design is well on the way to a first-generation aircraft, and the forthcoming third variant, variable-thrust design, an entry in the British competition. Stipulated modifications for the Royal Navy include provision for a two-place aircraft.

A natural question which arises additional speculation as to the future of the BMR program is West Germany's VT-100 high performance aircraft still under fixed-dash development by the government by a consortium, Bölkow and Messerschmitt, despite the economy. For a major reorganization it has been taken into the BMR competition (AWA Jan. 21, p. 10). This is in addition to the Pfeil-Wolf D-24 close-support fighter in the pilot's compartment.

ANNA Launch Fails
Cape Canaveral—Attempt to launch the ANNA prototype satellite into orbit last May 13 failed when the Atlas second stage failed to ignite. The cause was not immediately known.

It was planned to put the 1,000-lb satellite into a 600-mile near-high circular orbit at an inclination of about 90 deg. The upper stage cut off in Air Force specified landing position which was to have been based on ultra short three days, or about 100 miles. The ANNA dual frequency transponder and a Navy Doppler receiver with low transmission noise in the Thorntech navigation satellite system (AWA May 18, p. 30). A backup ANNA is available and will be scheduled for launch about a month.

10,000-lb gross weight class being developed under government contract is a replacement for the first GSAT 1 in 1966.

Speculations here as to when a decision will be reached within NATO on type or types of aircraft to add to evaluation quantities range from late summer to early next year.

Although little or no official detail has been forthcoming on the BAC entry, the design is believed to depend upon eight hardtop, located horizontally, probably a version of the 6,000-lb thrust Rolls-Royce RB.162, for VTOL flight. Most of the wings are located in the mid-fuselage section, the other four in the aft fuselage spaced on either side of the conventional tail fins as given to it in its configuration.

Maximum gross weight of the advanced variable-thrust aircraft project is reported to be in the 30,000-lb to 35,000-lb category. Projected performance is believed to be comparable with that of the Republic Fokker D-24.

The D-24, also a variable-thrust aircraft based largely upon work done by National Aerospace and Space Administration and Republic in this field, can put the part several years in an on-the-deck capability of Mach 1.25 as well as Mach 1.50 at altitude. It can fly with its hydraulically-actuated canards wing extended at speeds up to Mach .92, and, with wings retracted, can land in a vertical position.

With an external auxiliary fuel tank mounted on top of the fuselage behind the cockpit, the D-24 reportedly exceeds the VAX requirement that an aircraft have a flying range of more than 1,000 m. The high-wing aircraft, including a conventional vertical fin and stabilizer, has as nose wheel housed under the forward cockpit with the main gear located well to the rear of the fuselage. In a two-place Navy version, the main second seat for the radar operator would be placed directly behind the pilot's compartment.

Polaris Shift Part of U.S. Move To Pressure Other NATO Nations

By George C. Wilson

Washington—U.S. government of the Polaris submarine to the North Atlantic Treaty Organization represents just one approach the Kennedy Administration is taking in its over-all program to pressure West Europe to invest more heavily in its military alliance.

The Polaris submarine armament—coming as it did during the NATO Council of Ministers meeting in Athens—had considerable psychological impact by contrasting the U.S. arms build-up with the failure of other Atlantic nations to meet their NATO commitments. The U.S. has increased its nuclear stockpile by 100% since the 1963 non-nuclear test ban.

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Maximum gross weight of the advanced variable-thrust aircraft project is reported to be in the 30,000-lb to 35,000-lb category. Projected performance is believed to be comparable with that of the Republic Fokker D-24.

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With an external auxiliary fuel tank mounted on top of the fuselage behind the cockpit, the D-24 reportedly exceeds the VAX requirement that an aircraft have a flying range of more than 1,000 m. The high-wing aircraft, including a conventional vertical fin and stabilizer, has as nose wheel housed under the forward cockpit with the main gear located well to the rear of the fuselage. In a two-place Navy version, the main second seat for the radar operator would be placed directly behind the pilot's compartment.

effort to be given closer to NATO. The French government announced last week that it had exploded a nuclear device underground May 1 at its Sahar testing ground. This was the fifth announced nuclear explosion by France since the country embarked on its own nuclear development program, either than on NATO.

Nuclear agreements at the NATO meeting were limited to giving the members an alliance a voice in developing guidelines for the use of tactical nuclear weapons and informing the governments of the size and location of nuclear stockpiles within their boundaries.

The type of psychological pressure the U.S. exerted in Athens is an effort to assure every one of the NATO members will be combined over the next several months with extensive reforms designed to achieve the main objective. The U.S. unbalanced balance of trade and West European prosperity are spurring the effort.

Additional Funds

For fiscal 1963, President Kennedy requested \$1.7 billion for the entire military assistance program, with \$60.2 million of it slated for NATO countries. The Kennedy Administration is proposing an addition of \$120 million in increased military assistance to France to bring the fiscal 1963 total to \$1.719 billion. The \$1.7 billion for fiscal 1963 compares with President Eisenhower's request of \$1 billion for fiscal 1962 and \$1.7 billion for fiscal 1961. Congress gave the fiscal 1962 request to \$1.6 billion and the fiscal 1961 request to \$1.7 billion.

The \$1.7 billion fiscal 1963 request would be distributed this way: Europe, \$114 million; Africa, \$35 million; Near East and South Asia, \$421 million; Far

Military Assistance to NATO Declining

North Atlantic Treaty Organization share of U.S. Military Assistance Program funds has declined from 40% to 10% over the last four years. This chart compares the percentage of MAP funds allocated or slated for each region, as well as NATO, from fiscal 1958 through fiscal 1963.

Region	FY1958	FY1962	FY1961	FY1960
Europe	10%	10%	20%	30%
Africa	2	3	3	1
Near East, S. Asia	24	22	21	16
Far East	48	46	41	36
Latin America	5	4	3	3
Multi-regional	3	3	4	4
Total	100%	100%	100%	100%
NATO	10	16	41	41

* Assumes that funds cover more, such as communications equipment.

N-156F Schedule

Northrop Corp.'s first production N-156F for foreign air forces under the Overall Aerospace Program is due in the Soviet Union this fall at 121,000. Meanwhile, Company's first jets will be delivered immediately to the first production line which bears company number of 6000.

A second prototype, another aircraft which was partially completed when USAF halted the program, will be completed and put into testing by late 1963. First production aircraft will be delivered two months later. Expected date of arrival will be in quantities of 60, enough for one group of three fighters apiece, roughly equivalent to the present 300-3 specifications for the four-seat

Data Indicates Centaur Structural Failure



CENTAUR C-2 vehicle is launched by NASA at Cape Canaveral (top) and is engulfed in fire (bottom) 55 sec. after normal liftoff and early flight. Photos by Alan D. Rossiter

Cape Canaveral-Preliminary test data and census data on the most recent flight last Tuesday of National Aeronautics and Space Administration's Centaur C-2 vehicle indicated that a structural failure started "at the area of the junction between the nose cone and the Centaur stage."

Centaurers followed the failure, which occurred about 55 sec. after an apparently normal liftoff and early flight. NASA said that detecting the cause and exact location of the failure would depend on a more detailed analysis which is now going on at Cape Canaveral and San Diego.

But there was some speculation of a possible cause in a few observers at the Cape and in the Centaur blockhouse. They suggested that one of the gimbals, which pitch on the Centaur stage—either one of the four cold-gas steering system nozzles or one of the nose-cone bolts or an equipment brace became detached, pre-maturely and punctured a tank.

This was the ninth attempt to fly the Centaur vehicle, which is located in a modified General Dynamics/Aviation Research Model AD-1 intermediate ballistic missile. Centaur was built by a joint contractor to the Air Force and the Air Force Research Institute at Wright-Patterson Air Force Base. It is powered by a pair of Pratt & Whitney RL10A-2 rocket engines developing 15,000 lb thrust each and burning liquid hydrogen and liquid oxygen (AVW Apr 2 p 52).

One major objective of the planned flight was to determine behavior of the liquid-hydrogen fuel under low-thrust zero-gravity environment and during unusual maneuvers and accelerated flight.

Centaur stage is 42 ft long, 10 ft in diameter and weighs 31,000 lb at separation. Forward portion of the stage is a 14-inch-dia nose cone, made of two half sections and a cap, and weighing a total of 750 lb. Its purpose is to protect against atmospheric heating and to restrict the heat transfer from the nose section to the liquid hydrogen. This 18-ft long cone is designed to be jettisoned about three seconds after liftoff, released by explosive bolts and impacted in the air, as in a few small reentry vehicles.

There are four pyrotechnic quarter panels of insulation around the liquid hydrogen tank, between the base of the nose cone and the intermediate adapter. This is made of glass fiber, faced on one side with aluminum foil and then Paraflex, an insulator at the bottom by layers and held with spring-loaded tension straps secured to a

MMRBM Competition Target Date Scheduled

Out 30 target date for submission of reports by the seven missile contractors who will be selected in Phase 1 of AFSC's Ballistic Systems Division's competition for the mobile medium-range ballistic missile (MMRBM) program being advanced for the AFSC system.

Phase 1 is a program definition phase. Proposals by the various missile contractors are being submitted at different times during this period, and ESD probably will require 90 days to evaluate each proposal, which is expected to be enough time for the program definition phase.

Phase 2 is a development phase for Phase 1 missiles.

Phase 3 is a production phase for the MMRBM.

From the Phase 1 contractors, ESD will select a program to provide cost savings.

Phase 1 is expected that more than one contractor will be chosen to compete in each category, but it is anticipated that only a single contractor will be selected for each category.

The second phase will encompass design, fabrication, evaluation and operational test and building of a prototype system, as well as establishing a production plan for an operational version.

Phase 2 will provide incentive advantages, so that it will be possible for a contractor displaying unusual performance to earn a maximum fee and in the event of aside performance, earn no fee and also be held responsible for excess costs.

Phase 3, covering the acquisition of the operational system, is not yet authorized by Department of Defense.

plane bolts. The bolts were to have been blown by pyrotechnic detonators, releasing the panels in open out into the atmosphere and fall away.

Review of the launch and initial flight appeared suspiciously sound in observers' judgment of various systems, says a source. Centaur and booster engines were in proper condition to the Air Force source, who is a flight test engineer at GID/A. It is powered by a pair of Pratt & Whitney RL10A-2 rocket engines developing 15,000 lb thrust each and burning liquid hydrogen and liquid oxygen (AVW Apr 2 p 52).

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Centaur's structure, which is in fairly shallow, shallow shell which extends off the nose section base, NASA said, however, that the measured deflection would not add materially to determining cause of the launch failure. Some of the glass-fiber covering failed in low Wednesday, on the roll, but this was of no value in analyzing the failure.

X-15 Heating Reaches 1,250F During Flight

Edwards AFB, Calif.—Astronauts heating caused temperatures in the lower speed brake of the North American X-15 research aircraft to 1,250° during a flight made by Air Force Flight Test Center Test Pilot Maj Robert A. Barth on Mar 8.

Preliminary data on Barth's flight, which was planned to be an operational flight, is planned on the outcome of Wasowicz's flight and is expected to be in operation some time next year.

Wasowicz showed also that temperatures on the lower wing surface and on the bottom of the fuselage reached 900° to 1,000°. The flight was made at relatively low altitude, 12,000 ft, but at high speed. Maximum speed was Mach 3.3 at 15,100 mph. Return from the flight took 11.89 min.

Barth's previous record by the same vehicle under similar flight conditions was 1,150° while flying at Mach 3.12 on 3,670 ft, even though at 73,000 ft altitude. The endurance performance is only 9% of that at sea level.

United Aircraft Corp. reported net income of \$4,367,188 during the first three months of 1963 compared with \$2,815,979 for the same quarter in 1962.

News Digest

Aerospace-General Corp. has signed a \$17 million letter contract with the National Aeronautics and Space Administration for the design and development of the M-11 conical nose section of which will power the second stage of the Nova launch vehicle (AVW Apr 16 p 31). M-11, burning liquid hydrogen and liquid oxygen, will develop 1.2 and less than 10 lb thrust and will burn 84 more of the fuel in one minute.

Shuttle 564 rpm orbital potential flying rate made its first flight last week. The 20 min flight included both longitudinal and lateral motion.

Canadian Bristol Aeroplane Co., Ltd., a joint-owned subsidiary of Avco Corp. and the Bristol Aeroplane Co. of Canada, Ltd., has been formed for production of solid rocket propellant boosters. A \$2-million production facility is planned on the outskirts of Wasowicz and is expected to be in operation some time next year.

The Wasowicz's major parts were in the upper portion, designed and built by the Nova launch vehicle company at Edwards Air Force Base, the propulsive vehicle group. The M-11 was the primary power for the propulsive section, which had two solid rocket boosters and a solid rocket motor.

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From *World Airlines* and the Air Line Pilots Assn. hot work speed to a new contract calling for wage increases and including a proposed reduction in the crew membership quota. The contract was signed in time to avert a threatened strike. Details on the new complement issue will be worked out after June 1. The ALPA indicated that agreement had been reached on basic principles.

Col. Otto J. Glaser has been named new commander of Air Force's Electronic Systems Division. He succeeds Col. Paul M. Elling, the vacated, ousted when Maj. Gen. Charles H. Terhune, Jr., was elevated to ESD commander. Ellinger, a command pilot, has been recommended for higher command.

De. John L. McRaven has been named director of defense acquisition research and engineering test and service programs. He is an formerly president of HRL Laboratories, Inc., of Santa Barbara, Calif. Paul A. Price, Jr., has been named deputy DOD test director and defense test director. He now becomes manager of advanced weapons planning of North American Aviation, Inc.

First of two Mariner 8 space-8 ft probe to Mars will be launched around Aug. 16 from the Atlantic Missile Range. U.S. will attempt another lunar impact with Ranger 7 about Nov. 14.

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NASA Funds Cut

Washington-Bureau Source and Aerospace Committee last week approved a bill authorizing \$3,762,000,000 for the National Aeronautics and Space Administration for fiscal 1965, representing a paper reduction of \$44 million but an actual cut of \$106 million in the requested amount (AVW Apr 16 p 25).

The committee's major cuts were in the Agency's Research budget, including the Space Research budget, and in the Space and Communications budget. The \$11.8-million reduction in the Research budget was the result of a decision by the President to eliminate most basic research which was cut and reductions were made in the existing scientific observers and orbiting geophysical observation programs. The remaining budget \$773 million is to compensate NASA for money it took from its research account the year before to pay for land and facilities. The money, however, cannot be used for fiscal 1965 projects.

Atlantic Opinion Viewed as Merger Boost

CAB staff recommendation to eliminate Pan Am, TWA
European competition seen as support for union.

By L. L. Doty

Washington—Recommendations by the Civil Aeronautics Board still last week for a retention of the "open" concept on transatlantic routes is being viewed here as a favorable argument for a merger of Pan American World Airways and Trans World Airlines (AW Mar. 7, p. 47).

The recommendation was contained in a 74-page staff report which proposed elimination of direct competition between the two carriers at major European points by granting Pan Am exclusive rights to serve London and Frankfurt and TWA similar rights at Paris and Rome.

Proposers of the merger plan in the staff proposal, which, in effect, gives each carrier monopoly routes, endorse the theory that European air travel markets are inadequate to support both U.S. carriers. They add, however, that two carriers operating monopoly routes will be weakened by application of European market and that each, through an airway monopoly contract with the U.S. carriers, the strength it needs to maintain the deep inroads being made by foreign flag carriers in the North Atlantic market.

'Chinese Instrument' Policy

This, they believe, can be achieved best by a merger of the two airlines, which would use the Board's flag-granting power with the knowledge of which carrier would be retained in the event the "Chinese instrument" principle was decided to be used. In its report, the Board would decide the final status of the chosen instrument there.

"The staff does not believe that now is the time to allow the historic natural power of regulated competition for a policy of a U.S. monopoly, nor in the North Atlantic."

Some observers interpret that wording to mean that, since the staff did not take positive opposition to a single carrier operation and appears to imply that the time for such an operation isn't far off, the use of the chosen instrument is by no means dead. Violent opposition has kept it shelved for 14 years.

Champions of the chosen instrument—particularly Pan American, are anxious to repeat it as a factor in the Board's Transatlantic Route Review Case as recognition which was maintained by an order which accompanied the staff report.

The staff, in its report, chose the realistic road between regulated competition and the choice instrument—the use

of strict criteria to ensure the proper development of air transportation is no longer necessary. It does offer this reason for cherishing competition or disengaging routes.

To the 15 [North Atlantic] flag-carrying flags in a group have the option not only to fully compete, but actually to enhance one another. We can have our own two carriers fully competitive against each other in the transatlantic European market—London, Paris, Rome and Frankfurt—while their foreign counterparts are not only growing in size strength and area but, also engaging in expanding pooling arrangements and like activities designed to further enhance their competitive opportunity. The elimination of competition between the U.S. flags would allow each carrier to get its full strength in the markets served against the foreign flags."

The staff then goes on strongly in defense of a non-competitive route system by stating that "there appears to be strong evidence that if two U.S. carriers are to survive successfully in the area, then this route should be allowed to reflect noncompetitive rankings."

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ATC System Research Cost \$50 Million

Washington—Federal Aviation Agency, or the body that preceded it, invested at least \$10 million over only 1958 in an unsuccessful attempt to develop the semi-automatic air traffic control system known as Data Processing Control, an agency report to the Senate has disclosed.

Using every research and development contract awarded by either the Airway Safety Board or the CAB since Aug. 1, 1957, the report (AW Mar. 18, p. 40) indicates the agency invested at least 100 contract contracts worth about \$40 million during the four-year span. But the figure excludes salaries, grants and some ATC work funded by the military services, which could be included under total DPC expenditure.

Sen. Warren G. Magnuson (D-Wash.) had requested the breakdown in a May 10 letter to FAA Administrator N. E. Huddles. The agency's response, although it mentioned 20 separate awards of four past biennia, did not include the dollar value attached to each contract. For this reason, it cannot be reported to give internal Senate committees a precise indication of how much FAA invested in research, research worth it actually spent, or on what projects associated with DPC.

Next to the contract summaries report that 60 major pieces of DPC equipment were delivered to FAA between December 1959 and March 1961. Some of this will find application in an experimental ATC system at the agency's Atlantic City, N. J., test center, which remains unoccupied by the Project Resonate system on which contract could be to name.

According to the report, the "lack of the traditional/transient part of DPC has already forced it to be delayed to Project Resonate's system/terminal assessments now." The Resonate report recommended that an ATC system which relies on total and instantaneous knowledge of all aircraft in the system be developed over the next five years at an added cost of about \$500 million.

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The study stresses the steady decline of U.S. carriers' participation in the North Atlantic market—from 82.9% in 1950 to 51.5% last year—and that points clearly to the future. TWA, which enjoyed Pan Am's share of the market in 1951 and 1952, is now content only half in north trans-Atlantic Pan Am.

How is how the report compared TWA and Pan Am on a financial basis?

Again, recall that TWA's international operations over the past closest year have increased to a rate 10% after a 1957 \$100 million and an average rate of return on total investment of 2.77%. The figures also show that TWA's operating rate in the mid part of the last five years. As for Pan Am, while it has been operating probably stronger than period, as far as return on total investment has averaged only 0.44%. For the year ended September 30, 1961, Pan Am showed a \$1 billion profit, a profit which dropped from 1958 and 1960.

Given these figures, it would be natural that the two carriers are drawing on another's resources, but that the airway competition concept is not likely to succeed substantially.

The study compares with the White House study prepared by General Research Corp. in 1959 to more agency budget dollars in a few urban. For example, the White House study which was released during the long deliberation of the Transatlantic Airline Act, found that competition by two U.S. carriers at London, Paris and Rome was warranted and will continue to be warranted. It recommended one carrier service into Frankfurt but generally based direct competition "where traffic and other economic conditions give competitive enterprises the opportunity to engage in profitable airfares."

That is a measure of the staff recommendations outlined in the report. ■ Pan American would have exclusive access to London, Shannon, Dublin and Frankfurt.

■ TWA would have exclusive rights to serve London, Paris and Rome.

■ Second-round-the-world experience would be ended by terminating TWA's routes to Asia and transferring its allocated points to Pan Am.

■ Madrid would be removed as a stop on Pan American's South Atlantic route and Pan Am's North Atlantic route between San Juan and Rio de Janeiro, Latin America.

■ Brasilia, Maracaibo and Rio de Janeiro would be removed as stops on Pan Am's North Atlantic route, as would Philadelphia on TWA's North Atlantic route.

■ Pan American would be curtailed at Lagos, Nigeria.

■ Seaboard World's Atlantic authority would be reduced to an indefinite period and Rome would be added to its route.

Northeast, Hughes Tool Discuss Financial Aid After Control Ruling

By Ward Wright

Editor

CAB's Bureau Counsel, whose recommendations in the case were completely rejected by Robins, was not immediately available for comment. Bureau Counsel also has the right to petition for review.

Others, whose interests were not as closely tied to the outcome of the case, felt that Robins' decision was probably the least preferable of several alternatives available. To some, the decision and left a triggering device about whether Hughes Tool and Northeast had deliberately let it financial crisis come in the hope of getting concessions from CAB that might not have gotten under a more orderly, conventional procedure.

Two Board members, Glenn Gromer and Whitney Griffith, called the case probably as they do now in the Dec. 5 CAB order approving Northeast's route for the airline (AW Dec. 11, p. 41). Both members felt at that time that the airline and Hughes Tool could have, foreseen the coming crisis as early as 1958. Even if that had come to the Board in June or September of 1961, a conventional, understated, control procedure could have been put in under way then. They felt the members felt the Board did not have authority to grant the waivers anyway.

Robins was credited to note several times in his decision that he findings were "based solely on the record developed in the proceeding." While the hearing was open to evidence of an airplane flagged or unflagged activities on the part of Hughes Tool concerning TWA at Northeast, the record would not support any such charge, Robins said.

Robins and his decision was based on the law facts of the case and their relation to the public interest. These were:

■ Northeast's lessened financial and legal Northeast had at the start of the hearing that if the airline were allowed to open into straight line routes, it would be able to increase its revenues and the dollar. Robins said that these interests failed to take into consideration the costs of clearing down, court costs and litigation liability. In other, bankruptcies would probably wipe out the interests of the general creditors and the stockholders would get nothing, Robins said.

■ Northeast's employees, Northeast's 7,900 employees would be degraded if liquidated.

■ Recognition under Chapter 10 of the Bankruptcy Act. Robins and the

out. Any such compensation would depend on subdues and subdues does not appear to be available. In addition, under Chapter 10, Northeast's entire turboprop fleet would be subject to repositioning.

If subdues were available, subdues and it would be sufficient to reposition the entire Northeast and it would need about \$3 million to meet its obligations this year and as much as \$20 million to completely change its operations. Also, subdues would be available only after action and hearings and would take time to complete within 30 days.

The lawyer, Carl R. Poldak, has contacted to produce about 200,000 sheets of comment cards from the new union's head chairman, F. Earl Johnson. Other investors have agreed to tell Poldak about \$40,000 additional shares.

Attorneys for the two companies last week were granted a preliminary ban of the Civil Aviation Board Required, Kansas-Oklahoma Local Service, comprising a decision by the inspectors on the feasibility of moving the two unions' Service areas of the two unions across the Midwest and Southwest.

Northeast, not due to its role as a substantial creditor, subdues said. Assuming that Hughes Tool did gain control through its creditor relationship to it, "we would do it to do."

To dislodge Hughes Tool's control, Northeast, like the National Airlines' board, may, so far as the law permits, if Hughes Tool is unable to obtain the assistance from a substantial creditor, would be an unreasoned application of the law and would serve no useful purpose, subdues said.

Robbins dismissed Boren's Council of Pilots' proposal (AW, May 7, p. 17), which would have granted special pending reclassification of the New York Islands route east, as "unreasonable, impractical, imprudent" and "possibly illegal."

Robbins said such a provision would be impractical because it would expand the route, impractical because it would require a substantial increase in the start-up financial risk to be placed on an upgrade, impractical because it made no provision for Hughes Tool's receiving its reclassification in a timely manner and illegal because it would create a substantial precedent for a route case.

As for testimony by Edward Hughes, Robbins and an audience in the case insisted that direct testimony by Hughes would affect the basic facts of the case.

Other issues in the case involved is Hughes were:

• First control of TWA by Hughes Tool. Early in the case, it was apparent that Northeast had no right to insist it receive first control of TWA. Northeast's argument was that it would have been a waste of time to investigate the efficiency and economics of Hughes Tool's TWA management agreement, Robbins said.

• Hughes Tool's ownership of West Coast 800s. Robbins said he was not con-

fident of what he knew. Northeast, he said, may be able to use the subsidy to advantage, but such use should be subject to CAB approval.

• Restraint of competition. Robbins said that on the contrary, Northeast control would increase competition rather than restrain it. Northeast itself, its competition would be eliminated on its franchise routes.

• Possibility of Hughes Tool bankruptcy. Northeast for its purposes, Robbins discussed, was the one, while Hughes Tool's present \$11-million investment in the airline is to be split into \$10 million upon approval of control. He decided whether his board could effect that ban.

Survival Not Assured

Robbins and all the evidence points to the fact that Hughes Tool wished to keep the airline flying, get permanent Florida authority and merge with TWA. Robbins said, however, it is still not certain whether Hughes Tool could make the airline. Hughes Tool has promised that it would use its best efforts to provide at least some financial aid for Northeast.

Whether advancement of more money would be, as Hughes Tool's opinion, consistent with sound business practices would be left in the company. However, if Hughes Tool is unable to manage the airline, Robbins and the el- ders will be as severe as when the airline was run bankrupt immediately.

The only conclusion Robbins placed on the merger was to be effective as long as no transacciones between Northeast and Hughes Tool or any of its subsidiaries do not exceed \$200 per individual item of property and not to exceed \$10,000 total value for the year.

Northeast will require all cash transacciones with Hughes Tool together with a cash deposit in a bank to its credit line, less than \$100,000 (AW, April 10, p. 49).

In addition to government guarantees on loans, Robbins said such a provision would be impractical because it would expand the route, impractical because it made no provision for Hughes Tool's receiving its reclassification in a timely manner and illegal because it would create a substantial precedent for a route case.

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New Short-Haul, Cargo Aircraft Urged

By Katherine Johnson

Washington-Los Angeles, May 13—Production of short-haul and short-haul cargo aircraft, such as the Boeing 727, the McDonnell Douglas DC-9 and the Douglas DC-10, is growing rapidly and such aircraft could fill a large gap existing for five years between most guarantees on loans to lend servicer carriers for regional airlines.

Montgomery, chairman of the Southeastern Aviation Subcommittee, who has strong support by the Commerce Department and the Civil Aviation Board, which endorsed both the measure to facilitate the financing of acquisitions for the 727 DC-9 in the local service airlines' fleets, and also recommended that the provision for greater loan guarantees of equipment purchase loans be extended to the confederated air carriers.

U.S. Secretary of Commerce for Transportation Clarence D. Miller told the Montgomery subcommittee that the need for additional incentives to increase civil air cargo capacity is "clearly evident." From detailed figures of the Joint Chiefs of Staff which show "a very real deficit for both road and bailed military emergencies."

"The lack of capacity to meet Joint Chiefs of Staff requirements for bailed out is a prime reason for urgent action to provide incentives to increase the cargo capability by the civil air transportation system."

The need for replacement of the DC-10, which went out of production 16 years ago, was highlighted in a recent speech by CAB Chairman James S. Boren, who recommended it as a 24-passenger aircraft with a cargo capacity of 10,000 cubic feet or less than \$100,000 (AW, April 10, p. 49).

In addition to government guarantees on loans, Montgomery proposed two other measures to assist the aircraft manufacturers—new funding to \$40 million a year with CAB, making a total grant under this program of \$40.4 million within five years.

The 62 aircraft already obtained under the joint venture program were: 34 Fairchild 27A, 12 Convair 340, 7 Martin 2-0-2s, 4 Boeing 707s, 4 Vertol 440 helicopters and 6 Vertol 107 helicopters.

The funding application was for \$4 million for 4 Convair 340s, 2 DC-9s, and 4 Vertol 61 helicopters.

ALTA has established a committee headed by Alphant Airlines President Leslie D. Boren to work with government agencies to establish special criteria for a DC-10 replacement (AW, May 7, p. 18).

Montgomery endorsed the Federal Aviation Agency's having a "National Airline" program providing for the development of an aircraft that can be used in regional transoceanic routes, DC-10 successor and freight flights on a transoceanic transpacific. This will cost no \$50 million for studies which will give a cost estimate," Montgomery predicted. "It will cost another \$500 million for one prototype."

A campaign by Montgomery a few years ago for guaranteed loans for all cargo plane purchases collapsed under the ill-weather. Administration opportunity-averse loan the Commerce Department and the nonstop opposition of major passenger airlines, including American Airlines and Pan American World Airways.

This year, Montgomery says only has Kennedy Administration support, but the method is that the passenger carriers will return fares taking a public position and burden the Administration.

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U.S. Secretary of Commerce for Transportation Clarence D. Miller told the Montgomery subcommittee that the need for additional incentives to increase civil air cargo capacity is "clearly evident." From detailed figures of the Joint Chiefs of Staff which show "a very real deficit for both road and bailed military emergencies."

"The lack of capacity to meet Joint Chiefs of Staff requirements for bailed out is a prime reason for urgent action to provide incentives to increase the cargo capability by the civil air transportation system."

The need for replacement of the DC-10, which went out of production 16 years ago, was highlighted in a recent speech by CAB Chairman James S. Boren, who recommended it as a 24-passenger aircraft with a cargo capacity of 10,000 cubic feet or less than \$100,000 (AW, April 10, p. 49).

In addition to government guarantees on loans, Montgomery proposed two other measures to assist the aircraft manufacturers—new funding to \$40 million a year with CAB, making a total grant under this program of \$40.4 million within five years.

The 62 aircraft already obtained under the joint venture program were: 34 Fairchild 27A, 12 Convair 340, 7 Martin 2-0-2s, 4 Boeing 707s, 4 Vertol 440 helicopters and 6 Vertol 107 helicopters.

The funding application was for \$4 million for 4 Convair 340s, 2 DC-9s, and 4 Vertol 61 helicopters.

ALTA has established a committee headed by Alphant Airlines President Leslie D. Boren to work with government agencies to establish special criteria for a DC-10 replacement (AW, May 7, p. 18).

Montgomery endorsed the Federal Aviation Agency's having a "National Airline" program providing for the development of an aircraft that can be used in regional transoceanic routes, DC-10 successor and freight flights on a transoceanic transpacific. This will cost no \$50 million for studies which will give a cost estimate," Montgomery predicted. "It will cost another \$500 million for one prototype."

A campaign by Montgomery a few years ago for guaranteed loans for all cargo plane purchases collapsed under the ill-

Continental Reports First Quarter Profit

Continental Air Lines last week reported a net profit of \$171,000 for the last quarter of the year, an operating revenue of \$107 million.

Operating costs for the first three quarters of 1970 were \$104 million, compared with \$114 million in the corresponding period last year. Net profit on the 1970 period was \$164,000.

The carrier said that the transoceanic passenger load factor reached a low of 45.2% in the first quarter, compared with 45.8% in the same period last year and 47.5% in the first quarter of 1969.

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and governments. Pilots are trained exactly and constantly. And given preference whenever they land at Air France. No other airline has higher standards for personnel. No other airline has higher standards for long range of operations. This dedication to perfection is a hallmark of Air France, world's largest airline with a record of 43 years of international flying experience.

AIR-FRANCE
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CAB, FAA Challenged on Dulles Policies

Washington—Whether the Civil Aeronautics Board and Federal Aviation Agency are unfairly pressuring air lines to use Dulles Airport has become a central issue in House consideration of new bills to establish a body to replace both Dulles and Washington National airports.

The issue cropped during recent hearings in the House Transportation and Commerce Subcommittee on two bills— one to establish an FAA-approved corporation to operate Dulles and Washington National and the other to create an independent board appointed by the President but not directly answerable to FAA.

The Kennedy Administration is backing the companion bill, FAA Administrator N. E. Hafley, and the measure would place the management of the two airports "in a sound business basis without encroaching the independence from the resources of the FAA." "It is essential," he said in a signed FAA report, "that no effort of the executive branch concern with the funding of airports be left to the party to the bill, the Congress and the President that the airports are being operated in a manner consistent with the public interest."

Concern for Friendship

Backers of the rival bill—sponsored by Rep. Daniel B. Boren (D-Mo.)—contended that FAA should not become involved in airport operation since this would conflict with its regulation role. George Robert Jr., representing the Airport Board of Baltimore, which runs Friendship International Airport, cited the case this way: "Dulles is assigned how best to run its flights now. This is the job of the operator of Dulles. Any other agency, including Congress, that has been here has the FAA right to say to it that it would still be an assigned loss by virtue of its dual and conflicting roles."

He also contended FAA's operation of National, changing the agency's National license ownership under that airport to the trustee to Friendship.

Chairman Bill Williams (D-Mo.) told Airline Week his subcommittee definitely will report a bill this session, probably within the next few weeks. He cited the Administration's bill "the only practical approach." The Administration bill, with technical amendments, most likely will be the one reported.

The question of whether CAB and FAA are being unfairly pushed to use Dulles and Washington became an issue on two bills. Rep. Sonny N. Finch (D-Md.) had by a "senseful of what will happen to Friendship International Air-

port" when Dulles excess what FAA is going to do and what the CAB is going to do to shift these offices out of Friendship.

He said the CAB's intention to force some savings Washington to load at Dulles is an example of using regulation, given to the detriment of Friendship.

Official Resistance

Rep. Foyld's extensive negotiations of Bored and Hafley about using their regulatory powers for the purpose brought their agreement during the House subcommittee hearings May 10 and 11.

Bored: The source to be passed through is going to be what the traffic demands. The fact that the airlines have reached an agreement with the FAA on landing fees at Dulles doesn't entitle them to land at Dulles, they are going to put the airlines where the business is. And if the traveling public wants to go in or out of Washington, they will go to Friendship, that is their home, because they are going to the ride.

Hafley: Let me assure you that I have not and will not—no, the legislation, powers that Congress has so imposed in the office, I hold to exert the air carriers to do anything against their will. We are not trying to eliminate jet flights at Friendship. We are trying to provide an additional airport at Friendship, Va. in the best possible manner and the public will determine at the end whether or not the traffic demand is there at home.

FAA Persuasion

He added, however, that in trying to prevent airlines to use Dulles "we don't want to be the last of a handful to keep friends will always prevail, but we research are not going to use our regulatory power or the FAA to hold them from flying there will."

The public is going to decide this in the end. Rep. Finch said he accompanying each flight that Friendship only needs

but begins to make money. "We have to keep Friendship alive, that's all there is to it," he said. Dulles Airport "is a white elephant and should never have been built and I am not in accord with it at all, and I hope things are from," Rep. Finch added.

Dulles preferred that "as populations expand...in expansion continues, as the carriers get heavier financials and more able to offer more productive services, more comfortable services, there is going to be need for Friendship, for Friendship, for Washington National, for Dulles."

He said the opening of Dulles would be "a numbers unfavorable factor" for Friendship.

Certificates Renewed For 3 Cargo Airlines

Washington—CAB's Airline Board last week issued the certificates of Flying Tiger Line and Stark Airlines for an additional second and Middle Airlines' certificates for first rates in rating on the four-year-old Domestic Cargo Mail Service Case.

AAXICO Airlines' application for an annual rate denied.

The order gave first rates authority to Flying Tiger and Stark—the south central and south central parts respectively, Middle for north south authority. All renewed certificates prevent carriage of non-airmails, mail.

AAXICO's certificate was not renewed because the carrier never came aboard service on one of its two routes, and it applied for renewal from initial authority to enhance its former.

In a decision opinion, CAB members Charles G. Clegg and Whitney C. Dillard said the Board "envies" of only one existing carrier—Flying Tiger. Renewal of Stark's certificate would cause an economic disservice from Flying Tiger, they said. Both members favored no renewal for north south cargo carriers.

Friendship Finance Breakdown

Friendship International Airport opened July 23, 1959, but money entry year until 1960—the first full year that jet aircraft and Friendship, New Maryland officials for Dulles International Airport will take over to such jet traffic that Friendship will experience deficits again.

Year	Revenue	Costs	Deficiency
1957	\$10,015	548,796	—11,975
1958	566,417	663,215	—96,691
1959*	160,215	732,769	—572,554
1960	860,000	781,215	18,635
1961	1,267,014	895,708	376,993

* Jan began using Friendship as a 61999.

MISSIONS & MILESTONES

THE FINE HISTORY OF THE BOEING-VERTOL TANDEM ROTOR "FAMILY"

MODEL XHRPX

1945: Developed for the U.S. Navy, the XHRPX, world's first successful tandem rotor helicopter makes first flight on March 8.

MODEL HUP

1945: The Boeing-Vertol HUP plays a key role in the war, following the success flight of Lt. Colonel John Glenn. In the accompanying photograph the helicopter is flying the admiral from the Destroyer U.S.S. *Nissei* to take him to the U.S.S. *Ramapo*. 1948: HUP is first helicopter to be flown with an automatic pilot.

MODEL H-21

1952: Boeing-Vertol H-21 assault helicopters are equipped in large numbers by the U.S. Army to conduct assault war operations in South Viet Nam. 1961: The French Army puts H-21s into service in the Algerian conflict. (This more than one hundred reproduced since have produced invaluable operational data used in developing improvements and refinements in later helicopter models.)

MODEL 107

1962: Passenger airliner configuration of the 107 is certified by the FAA, delivered to Pan American Airways. 1967: Military version of the 107, the CH-46, flies competition for a marine transport helicopter.

MODEL HC-1B CHINOOK

1969: The HC-1B Chinook, America's most powerful helicopter, is in large scale production and flying, attaining speeds over 150 mph with higher than normal maximum loads. 1981: First Chinook completed and ready for ground trials. 1981: Vertol Division gets go-ahead to develop a new 2-ton capacity transport helicopter for the U.S. Army.

VERTOL an **BOEING**

Cunard Starts Transatlantic Flights In Try for International Expansion

By Herbert J. Coleman

Montreal-Cunard Eagle Airways, based in its attempt at international expansion by advance sales from both the U.S. and the United Kingdom, moved into the transatlantic jet business last week when it puts its two Boeing 707s into London-Montreal scheduled service.

The decision to go ahead, long debated by both Cunard Eagle and its parent, the Cunard Steamer Co., may bring other disputes.

• **Promises.** aided by U.S. domestic long-haul airfares, to turn Montrealters to a gateway for London, planned to facilitate connection with other airfares to South America.

• **Reversal.** of Cunard Eagle's fight to obtain a license to operate its scheduled services from London to New York, in association with British Overseas Airways Corp. The license granted Cunard Eagle by the Air Transport Licensing Board last year (AVW Dec. 4, p. 41) was overruled by Minister of Aviation Peter Thomson.

• **Restatement.** of its case to fly charter flights to the U.S. before the Civil Aviation Board, which has turned the airline to 90% of its scheduled scheduled service between Britain and New York.

The latter decision, which has not yet been delivered to the airline as the firm of a ruling stems from Cunard's application for a CAB certificate, made it the first of Cunard Eagle Airways, East of Britain corporation.

At present, according to Bunting, Cunard Eagle's largest problem—so far—seems to be cost competition. The airline has never been subsidized and was in the red last year. The two Royal Canadian mounted forces were bought in anticipation of the London-New York scheduled air, on a firm contract with Boeing. The airline had an option on a third, now expiring. Boeing has a verbal agreement with the associations to deliver another 707 for delivery next year, but the decision will have to be made in October.

The Boeing deal is the first of Eagle's decision, whether it's up to ATLB for the New York service, but the decision to go ahead will rest on the growth factor on the North Atlantic routes this year. If transatlantic Boeing feels Cunard Eagle will have a capacity to use against the routes for the next year's revenue—ATLB's requirement to Victoria VC-10s and other aircraft from BOAC's total North Atlantic passenger traffic.

At the moment, the airline is fighting

and managing disputes, canceled this summer's flights. The number involved probably was about 100.

Bunting told Aviation Week the application was first made in April, 1960. Last year, Cunard Eagle got 80 transatlantic charters, using British Britannia, but circumvented the CAB decision by flying to Montreal and then to New York. Customer resistance remains and this factors had considerable bearing on the decision to drop charter flights.

Bunting feels the Board misinterprets Cunard Eagle's corporate relationship the airline last week was preparing to retitle its case for acceptance from London as an application for a CAB certificate to the U.S. The CAB has weak, general similar rights to another Boeing independent airline, California Airways. It is what Bunting called "a strange kind of logic."

Diplomatic Aspect

The case for Cunard Eagle also will be accompanied by a supporting brief by the British Ambassador in Washington, thus placing the situation as a diplomatic, or State Department, level. This raises the possibility of reciprocal restrictive action by the British Ministry of Aviation which in the past has encouraged U.S. charter operators on the grounds of reciprocity in their British air travel with its resultant dollar benefits to the economy.

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to expand its domestic routes, such as London-Glasgow and London-Edinburgh, in the face of fierce opposition from British European Airways, the other state-owned carrier.

Bunting noted that in London-Glasgow, Cunard Eagle was taking an increased frequency. Bunting pointed out that "while BEA, we must not that we have a ground of commercial preference" and would schedule flights on the basis of traffic generation. Again, Thomson's has the power of final decision from where there is no appeal.

Because of the incompatibility, Cunard Eagle has given less emphasis to new equipment, with the exception of putting its two 707s into service. The airline is interested in the BAC 111 twin jet transport, but also has a look at the de Havilland Trident and Boeing 727 three jet transports for its domestic European routes.

Boeing, which has a company London with Reynolds, leading at Kidder Field with a stop at Newark before continuing to Miami. Cunard Eagle is claiming a Federation Aviation Organization decision for its marginal flight to Bensalem, covering the 1,495 miles in 6 hr, 55 min and 16 sec seconds. Turn-off and Royal Aero Club departure, west aboard the Boeing, which was flown by Capt. George Headcross. Total time to Miami was 13 hr, 46 min, which included a delay of 1 hr, 30 min at Nasua, caused by heavy rain and a sticking left wheel brake. Advertised flight time will be 12 hr, 45 min to London to Miami.

Through June, the airline will be operating 100 flights and will be adding flying 50 flights weekly at Bensalem and Miami. Nonstop nonstop service, serving by Boeing 737s, will be 12 hr, 45 min London to Miami.

American's 3-Month Loss Was \$5.5 Million

American Airlines last week reported a net loss of \$199,300 for the quarter ended May 31, compared with a net loss of \$1,066,300 in the same period last year.

C. R. Smith, American president, noted that the improvement does not necessarily represent an upward trend in earnings since profits in the 1961 first quarter were degenerated by a labor strike.

Revenue for the first three months totalled \$165.7 million, an increase of 27.1% over the \$131.1 million total for the first quarter of 1961. Revenue passenger miles increased 15.5% over the same period last year. Total operating expense rose from \$93.5 million to \$107.4 million.

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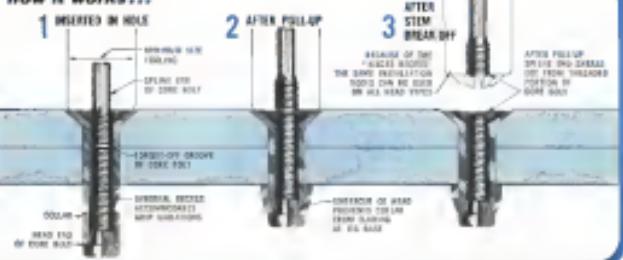
Three head styles are offered: an AN50900 slot to permit direct substitution with similar headed blind fasteners, a countersink slot for use in thin gauge material and a protruding style designed for minimum protrusion. Normal shank diameters range from .512 thru .818 while a unique oversize .660 units is also available. Gap lengths are in 1/16 increments with an additional built-in .032 gap for unexpected variations in part thickness. Beta Bolts are offered in alloy steel (180,000-360,000 psi

tensiile) and A-286 configurations. Other Beta Bolt series in 7075-T6 aluminum alloy, titanium and other temperature resistant and strength alloy are nearing the production stage.

Single Adhesive and Torque Driver tooling when combined with a flat straight and 90° standard power screwdrivers, engage the unique "sleeve" recess to install the Beta Bolt with a considerably less load exertion by the operator than normally required to install conventional fastened fasteners. Write for our new twelve page brochure describing the Beta Bolt, its strength characteristics, how it works and the installation methods used.

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how it works...



U. S. Airline Assets and Liabilities—Dec. 31, 1961

(In thousands of dollars)

	Total Current Assets	Investments & Related Changes	Property & Equipment	Total Assets or Liabilities	Total Current Liabilities	Long-Term Debt	Refined Credits	Bankable Equity
DOMESTIC AIRLINES								
American	101,412	4,210	334,702	470,422	126,417	213,702	42,872	331,093
Airail	22,740	2,821	21,482	70,154	15,361	40,561	8,416	37,328
Continental	1,558	32	307	3,127	293	39	1	1,470
Delta	14,199	9,192	48,954	70,153	14,199	23,392	2,000	34,797
Eastern	74,017	37,522	320,512	323,544	26,842	195,101	8,217	100,129
Midway	150	744	1,268	2,202	207	201	1,704	
Northwest	20,158	14,208	40,794	61,650	20,158	28,100	6,176	35,372
Southwest	43,548	6,321	543,019	583,310	56,813	93,216	12,854	44,397
Panama	14,252	2,719	39,484	57,443	2,719	12,321	176	16,887
Trans World	185,122	87,328	331,372	466,492	146,492	291,391	28,509	161,693
Other Airlines	1,203	3,315	4,361	6,936	147	1,204	1,012	1,012
Local Carriers ¹	114,702	77,315	384,401	450,493	56,015	282,713	31,126	87,185
Island World	132,960	8,416	320,371	443,336	119,268	280,603	38,863	100,000
United	11,466	7,140	10,531	83,020	16,141	21,107	12,810	12,810
Total & Subsidiaries Total	541,493	181,287	3,275,341	3,477,029	481,016	1,746,149	180,446	881,427
DOMESTIC SERVICE								
Air Mail	6,207	1,044	11,081	17,114	4,474	8,234	123	3,329
Reserve	2,408	212	4,291	9,497	4,000	4,000	265	265
Central	1,000	100	1,000	2,000	545	545	5	544
Eastern	2,720	210	4,056	7,181	3,165	1,837	12,348	
Isle Control	1,400	1,012	6,452	7,504	3,310	2,327	2,482	
Midwest	840	840	8,248	14,426	4,000	4,000	2,000	2,000
North Central	2,408	212	4,056	7,181	2,327	5,447	9,088	9,088
South Central	2,408	212	4,056	7,181	2,327	5,447	9,088	9,088
West Central	2,408	212	4,056	7,181	2,327	5,447	9,088	9,088
Alaska	2,720	210	4,056	7,181	3,165	1,837	12,348	
East Coast	2,720	210	4,056	7,181	3,165	1,837	12,348	
Midwest	840	840	8,248	14,426	4,000	4,000	2,000	2,000
North Central	2,408	212	4,056	7,181	2,327	5,447	9,088	9,088
South Central	2,408	212	4,056	7,181	2,327	5,447	9,088	9,088
West Central	2,408	212	4,056	7,181	2,327	5,447	9,088	9,088
Isle Control	1,400	1,012	6,452	7,504	3,310	2,327	2,482	
Midwest	840	840	8,248	14,426	4,000	4,000	2,000	2,000
North Central	2,408	212	4,056	7,181	2,327	5,447	9,088	9,088
South Central	2,408	212	4,056	7,181	2,327	5,447	9,088	9,088
West Central	2,408	212	4,056	7,181	2,327	5,447	9,088	9,088
Alaska	2,720	210	4,056	7,181	3,165	1,837	12,348	
Total & Subsidiaries Total	10,328	8,829	71,171	109,320	44,380	84,120	812	37,701
ASIA & PACIFIC								
Air Asia	2,233	903	5,412	8,800	4,024	4,126	31	1,416
Air China	807	103	209	3,179	273	273	495	
Air India	1,315	103	3,210	7,181	1,167	3,972	1	1,216
China	339	20	240	439	400	46	1,188	
El Al	227	18	140	1,240	120	120	28	1,060
El Alia	2,144	818	3,213	6,456	1,723	3,748	72	1,706
Endis	131	103	120	210	73	73	147	
Endis	1,429	103	3,069	3,454	1,024	1,024	3	1,201
Endis	1,429	103	3,069	3,454	1,024	1,024	3	1,201
North America	1,429	103	3,069	3,454	1,024	1,024	3	1,201
South America	1,429	103	3,069	3,454	1,024	1,024	3	1,201
Western Africa	1,429	103	3,069	3,454	1,024	1,024	3	1,201
Western Asia	1,429	103	3,069	3,454	1,024	1,024	3	1,201
Western Europe	1,429	103	3,069	3,454	1,024	1,024	3	1,201
Western Pacific	1,429	103	3,069	3,454	1,024	1,024	3	1,201
Total & Subsidiaries Total	34,129	2,324	58,302	47,729	12,398	16,244	724	18,304
MICROPILOTS								
Chicago	1,182	43	861	9,138	399	2	64	1,491
Los Angeles	499	64	1,059	3,691	1,040	437	23	1,375
New York	1,148	236	1,323	3,174	564	140	1,216	
Helicopters Total	2,727	1,040	5,689	8,193	3,235	581	881	3,436
CARGO & OTHERS								
AMCO	1,127	1	2,319	8,327	1,029	390	108	2,120
American	678	67	846	293	409	111	11	
Boeing	34	2	547	196	50	27	1	
Flying Tiger	12,197	16,401	26,773	53,194	63,446	1,631	17,322	
Malta	4,127	1,227	10,059	25,059	36,014	14,078	5,558	
Transoceanic ¹	4,410	4,385	28,133	38,358	2,710	28,133	1,392	2,864
U.S.	4,410	4,385	28,133	38,358	2,710	28,133	1,392	2,864
Cargo & Other Total	46,444	26,180	103,799	101,999	31,809	94,318	3,838	23,594
Industry Total	195,431	24,304	3,410,729	3,410,990	241,023	1,893,388	180,093	881,081

¹ As of Sept. 30, 1961.
 Transoceanic Report.

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FOR THE FIRST QUARTER (in thousands of dollars)

	PASSENGER REVENUE			TOTAL OPERATING REVENUE				
	1960	1961	Increase or Decrease		1960	1961	Increase or Decrease	
			Amount	%			Amount	%
DOMESTIC TRUNKS								
American	177,567	249,329	71,762	40	621,152	646,432	25,280	41
British	48,584	75,240	26,656	54	72,761	77,409	4,648	6
Canadian	10,200	12,000	1,800	17	4,240	4,600	360	8
Delta	117,081	141,593	24,512	21	182,379	182,352	24,076	21
Eastern	245,652	327,027	81,375	33	245,761	307,610	61,849	18
McDonnell	89,564	88,568	6,004	7	65,478	74,213	9,735	14
Northwest	10,200	10,200	0	0	10,200	10,200	0	0
Pan American	27,384	41,208	13,824	51	86,182	75,761	11,421	14
Trans World	101,441	205,216	103,775	101	207,161	179,446	31,307	15
United/Capital	419,731	485,210	65,479	15	466,193	377,379	27,154	13
Western	36,774	34,020	6,254	18	64,247	55,141	11,120	16
Total Total	1,016,484	1,074,029	57,545	6	1,049,419	1,079,348	30,929	4
INTERNATIONALS								
American	6,616	8,277	1,661	25	6,437	8,311	1,874	30
British	9,231	9,156	315	3	16,193	11,791	912	5
Canadian	2,200	2,200	0	0	4,200	4,200	0	0
Delta	2,178	2,112	6,600	101	2,388	2,432	44,010	186
Eastern	27,167	36,149	9,982	35	30,458	31,991	3,533	11
McDonnell	1,493	1,493	0	0	1,514	1,514	0	0
Northwest	1,200	1,200	0	0	1,200	1,200	0	0
Pan American	22,084	23,756	1,672	7	28,866	30,158	3,292	9
Trans World	14,793	14,111	1,883	9	19,198	20,811	2,613	14
United	219,269	303,545	15,276	5	415,784	428,324	47,570	12
Western	1,200	1,200	0	0	1,200	1,200	0	0
Total Total	494	418	141	42	674	640	34	19
Trans Caribbean	5,031	5,035	4	0	6,101	6,101	0	0
Trans World	27,188	61,842	34,654	100	120,230	83,270	27,480	18
United	31,171	32,000	829	3	25,244	25,244	0	0
Western	4,185	4,910	725	17	4,810	5,113	303	6
International Total	417,454	523,514	106,060	20	800,248	761,191	39,046	6
DOMESTIC AIRLINES								
Airline Total	9,101	12,812	3,711	41	16,419	20,105	3,686	28
American	8,000	8,148	148	2	12,000	12,200	200	1
Canadian	2,450	2,450	0	0	5,785	6,295	510	9
Delta	6,302	7,216	914	14	12,980	14,816	1,836	13
Lake Central	2,102	6,347	2,415	144	4,430	9,742	6,312	109
McDonnell	9,229	12,200	2,971	32	12,200	12,200	0	0
North Central	12,561	20,415	7,854	63	20,427	21,179	4,352	22
Orca	7,126	8,075	948	12	12,200	13,200	1,000	8
Pan Am	6,186	6,399	213	3	11,864	11,864	0	1
Southwest	7,126	8,210	1,084	15	12,200	12,200	0	0
Trans World	2,187	2,187	0	0	7,023	7,023	0	0
United	6,026	6,211	185	3	8,438	8,438	0	0
Western	6,107	6,249	400	6	12,200	12,200	0	0
Total Total	42,863	50,020	9,156	20	146,412	157,094	10,682	21
ALASKA & HAWAII								
Airline Airlines	2,303	3,077	774	37	2,312	2,720	408	18
Airline Central	1,003	2,020	1,017	101	2,234	2,126	108	181
Airline	4,484	4,896	412	9	4,629	5,660	1,031	11
Caribean	1,101	1,101	0	0	1,101	1,101	0	0
Orca	7,718	8,410	692	9	1,237	1,533	300	18
Hawaiian	8,210	8,210	0	0	15,220	8,568	12,652	172
McDonnell	8,171	12,141	4,070	50	11,200	12,200	1,000	9
Pan Am	7,221	7,470	249	3	11,200	11,200	0	0
Trans Northwest/Pacific	7,221	7,470	249	3	11,200	11,200	0	0
Trans Mountain	1,102	1,102	0	0	2,829	3,079	250	6
Trans World	2,187	2,187	0	0	7,023	7,023	0	0
United	7,221	7,470	249	3	11,200	11,200	0	0
Western	1,102	1,102	0	0	2,829	3,079	250	7
Total Total	38,739	38,486	6,253	17	30,449	31,860	1,411	6
HELICOPTERS								
Orca	1,019	1,422	393	38	3,456	3,589	133	134
Orca	224	249	25	11	1,492	1,492	0	0
New York	1,040	1,040	0	0	3,481	3,487	14	2
Total Total	3,044	3,691	647	22	9,387	9,589	202	135
CARGO & OTHERS								
Aero-Orca	—	—	—	—	8,026	1,469	3,367	116
Aero-Orca	—	—	—	—	3,182	3,182	0	114
Airline	371	439	628	16	4,444	4,766	322	74
Airline	371	439	628	16	26,437	33,104	6,667	20
Boeing	—	—	—	—	2,318	3,261	9,143	1198
Boeing	—	—	—	—	6,826	23,704	16,878	246
Boeing	—	—	—	—	6,826	23,704	16,878	246
Boeing	—	—	—	—	12,000	12,000	0	191
Cargo, etc. Total	371	439	628	16	23,107	31,401	8,294	46



LOCKHEED proposal for a VTOL version of the F-104 has two J57 turbofan engines, each in each wingtip pod, suspended with eight fairings (AW Dec. 15, p. 70). Forward thrust would be supplied by a Kestrel Rover R5-1000, a liquid oxygen rocket motor.

German Resurgence Revealed at Hanover

By Cecil Brewster

BONN, West Germany—Budding re-emergence of West German industry as a potent design development and production force in both civil and military fields plus the intense undersurface struggle among nations in the North Atlantic Treaty Organization strike fighter competition was on evidence at the 1965 Hanover Air Show which closed here last week.

Since German interest and design work on delta wings, canard free-planform aircraft, and canards have been for a long time left behind, with 1,000 mph cruise speed to match or competing partners for the potential third stage of the booster series for the European common space program.

Actual hardware outside the business-flying field was also thin, plus for production on all levels were evident at almost every static exhibit.

Signs that West German industry has survived its previous winning period and may be step forth again with original designs and production including VTOL aircraft were very evident. Speculation over the outcome of NATO's VTOL BOMER strike fighter competition was heightened by the new and defense ministers meeting in Athens where political lobbying is separate of actual design efforts was expected to be acute. The most announcement by Defense Secretary Robert McNamara in London that the U.S. government plans to allocate \$34 million for continued development of the Hawker Siddeley P.1127 vertical fighter and its Bristol Siddeley BS-53 variable-thrust propellant also was the cause of much second guessing here.

United States nuclear weapon devel-



VERGEL TRANSPORT MODEL of Rolls-Royce's two-jet aircraft (below) demonstrates the British firm's approach toward vertical flight for heavy aircraft where lift engines alone are insufficient. Two lift engines, podded in two wing pods, are augmented by two conventional turboprop engines under each wing mounted to take advantage of thrust assist (AW Sept. 15, p. 80). Closeup of Rolls' advanced thrust-engine installation (below) shows two podded engines under study, with the side-mounted nozzle cones curving downward to augment the lift engines in vertical flight.



opment funds committed goes only to development of the BS-53, which is scheduled to start development of 18-340 lb. in its production version, and to the 70,000 lb. thrust BS-100 follow-on, with due to expire in 1968, and officials here say the new pledge should allow the P.1127 to complete its development cycle and pass into the operational stage. While the nosecone P.1127 is not in trials in the NATO competition, the second and the apparent third stage development is now opposed to the variable-thrust concept as opposed to independent lift engines, a condition in which most could plane either the Mach 2 P.1127 follow-on at the Republic F-105 D-24 Allison, look powered by version of the BS-100, in a relatively stronger position.

West German designs for VTOL combat aircraft including the Focke-Wulf 106 and VF-801 under development by Messerschmitt, Bölkow and Bölkow were not shown.

Focke-Wulf, however, did display a model of a long VTOL transport designated the FW 200 with two wing pods, each housing an lift fan engine.

Planned lift engine should be the FW 200 be placed into production in roughly 1970. Bölkow's Bölkow 88-100 (Bölkow 88) is scheduled to begin trials later this year. Other German exhibits showing new projects included:

- Mockups of competing third stage booster units, one designed by Bölkow-Festwirkungs and another by the Northern Industrie Gruppe composed of Focke-Wulf, Hamburg Flugzeugbau and Wiesbaden. West German government with apprehension of pending third stage for European space boosters is expected to make a decision between the two in the near future.

Bölkow designs a boost stage as a stand-alone, tail-sitter.

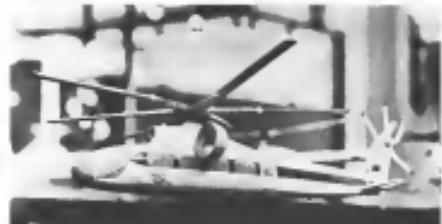
- A family of Bölkow transports, including one 200-passenger version with a design capacity of 180 seats. The first two designed to prove attainment of relatively high speeds in inter city systems in which blade load and blade torsion problems as far as possible (AW Mar. 12, p. 247). Posterior horizontal flight would be augmented by a max 2,500 lb. General Electric T70 engines mounted on either side of fuselage. Experimental two-place helicopter to test blade torsion concept in inter city construction and scheduled to begin flight tests late this year.

- Model of Bölkow's 2110B (posterior short range transport proposal) (AW Apr. 16, p. 10). Actual production will start in 1970, design of first entries for at least 20 to 25 aircraft.

- Handley Page's B.1014 (10 passenger aircraft) aircraft prototype is under construction and Handley Page's Dagenham is budget of a substantial



BÖLKOW MODEL 2110, planform configuration of a two-seat test vehicle now under development under government contract to evaluate the firm's high-speed lifting fan concept.



Possible SIX-BLADED, 25-passenger follow-on to the Bölkow test vehicle includes a small fan engine on either side of the fuselage to add to intercity flight. Cruise speed for the turbine-powered helicopter would be approximately 100 mph.



TWO-PIECE three-bladed helicopter with a rapid speed load system under development by Bölkow with private funds is scheduled to sell for about \$22,000 when it reaches the commercial market. Expected B.1014, the helicopter is to be powered by a NSU 9-rotor rotating combustion engine with a continuous rating of 190 hp.



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West German air force order for use in a navigation system.

• Dornier display emphasizing its work on space projects including Rangifer wing dragger. Dornier is building a new space research facility and reportedly will play a major role in future West German projects in this field. Dornier also is building a VTOL transport on a Dornier Mistral under a BIS 51 funded research contract.

Hawker Siddeley hopes to sell production quantities of the P.1127 vertical fighter to Germany and other NATO countries including the United States at low cost because that could be vital after the new fighter can also act as a VTOL transport when used in prolonged assault mode, their spokesman said.

Under present plans the P.1127 is scheduled to become operational sometime in 1964, as opposed to the 1968 date for the advanced P.1150. Operational schedules for other aircraft in the NATO competition are compatible with that for the P.1150. Powered by a scaled down version of the 18,000-lb-thrust BS 100, the P.1150 has sharply swept wings and thin streamlined fuselage but still bears a family resemblance to the earlier P.1127.

The Republic Fokker D.24 variable-sweep wing is the NATO competitor



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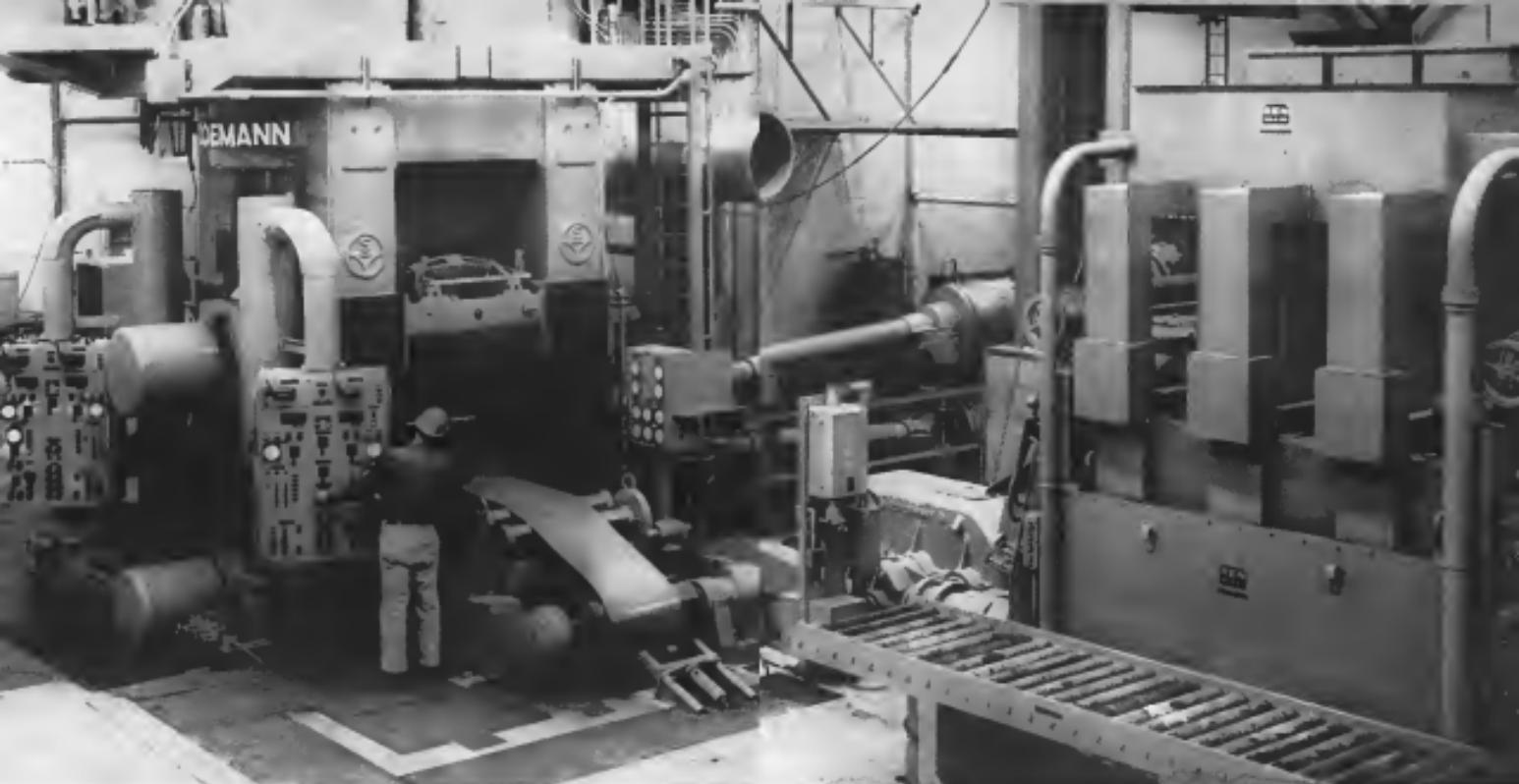
F-27 Capabilities Expanded for Military Missions

Fairchild-Searle Corp. F-27 twin turboprop transport has been awarded Federal Aviation Agency certification for a higher takeoff weight and wing load damage criteria. Fairchild officials said that the F-27G military version, designed for aerial cargo and personnel transportation, will take off at 41,000 lb. with a 22,000 lb. payload over a 60 ft. obstacle in less than 2,790 ft.

The aircraft manufacturer currently is building 31 F-27s for 12 airlines and 10 business corporations.

The F-27G will be demonstrative to military clients this month and in June, according to the manufacturer. The interior configuration of the aircraft provides maximum for medical evacuation missions after drops are disseminated. Large cargo doors are at cruise height for easier loading.





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STORAGE TUBE
A Hughes T-33 aircraft is shown with a Hughes direct-view storage tube under its right wing.



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telling us at a given moment of flight, or my comrades were staring at the right side of the cockpit and I had to do the same. Periodic voice augmented my strength and spirit, confidence in the mental accomplishment of my mission was growing. I knew that my comrades, who had all right parts at their disposal, were able to give me help if I needed it. And as a token of my gratitude, I made a simple offering to them when I was strength and told them about it over the radio.

Fight training at this point included flights to experience weightlessness and reentry. I also had to make white training, a complete set of regular training, to make the space suit and portable emergency supply with communication devices and also food.

Physical, training and medical supervision of my health were planned as an everyday task. The preselected medical training enabled me to fulfill the flight program successfully.

Now I am going to say a couple of words about the spaceship Vostok-2 and about the preparation of orbit.

The spaceship Vostok-2 is a guaranteed reliable apparatus. Its weight is about the last stage of the booster in 470 kg.

Six Engines

The spaceship was put into orbit by a multistage booster having six liquid propellant rocket engines of the Vostok type. The weight of the engines of the second stage of all stages is 400-500 kg.

After separation of the booster last stage, the capsule movement component and orientation stabilization component continue to orbit. The interior surface of the capsule is covered with a layer of heat shield by a protective coating, entry high temperature. For circulation purposes the capsule has five ports.

The ship's cabin is equipped with an optical monitor designed for determination of the heat balance and heating. The ship's equipment includes life supporting system, the communications system, the power system, pressure regulating system, food and water, the system designed for disposal of excreta.

Final water purifying plant, solenoid, electric power supplies, heat storage for the thermal insulation of the ship. From these, the ship is provided with the radio equipment for ship orbit control. The equipment for observing and recording photographical functions as flight, radio navigation equipment, independent recording system, television equipment, the control tracking and recording ship equipment, open circuit at flight.

The ship's cabin is equipped with a television camera for showing the camera and a Control center camera. The thermal insulation system and the controls.

After the astronauts have fixed the thermal insulation component separate from the capsule.

The idea and a component of the ship's equipment. In design provides for the realization of a number of functions intended with the possibility of a long stay in the ship's capsule. Besides, the ship's cabin for experiments, in case of necessity, of the capsule, its descent by parachute, and the removal of all that is necessary for returning the

cosmonaut after landing. It has necessary, food and medical supplies. The ship is equipped with an inflatable drogue which deploys automatically if descent is to be delayed or water.

All that equipment complex in connection with the gear not connect the components into a single system and programmed automatically.

Many of you know that this was an unusual mission by Gagarin during the first flight not by me, as in such case landing was conducted precisely in a given area.

Manual Control

Apart from the automation which can cause fulfillment of the whole program of flight, the ship is provided with manual controls for sharing all of the systems. The equipment is able to control the ship's orbit and orientation in space, to make a landing, a maneuvering, to open the parachutes, to land the astronauts, e.g., to land the ship, starting from top orbit, in any chosen spot.

The conditions onboard for man were strictly maintained in the cabin. Therefore, though it was open and the two persons were not separated before they kept open almost all throughout the flight.

The launching of the ship took place at 9 o'clock, Moscow time, on Aug. 6, 1961, from the following (Korzhikov) cosmodrome. The landing was received at 10 km. 15 minutes after Aug. 6, 1961, at the settlement of Krasnaya Polyana (Sochi, Krasnodar Krai). The flight lasted 25 hr. 25 min. The orbital period was 175 km., its apogee was 245 km. The orbit plane was in 64 deg. 35 min. inclination to the equator. The ship made more than 17 trips around the earth. The orbital period was 95 hr. 45 min.

The flight was proceeding as the following table:

On entering for orbit, the spaceship separated from the booster and began the flight program, which I will discuss in a moment. After 17 hr. 45 min. the reentry into the atmosphere began, decreasing the ship's orientation and atmospheric pressure was reduced. After passing from the surface of the earth, the ship was oriented to the sun and at a distance around the sun, the reentry began. Then the ship passed the atmosphere and the atmospheric reentry.

On reentering the atmosphere and decreasing the capsule down, at 1800 m. 100 m. and 200 m. per sec. are in descent, the reentry took place followed by gear deployment.

Personal Impressions

This was the greatest outline of the flight. Now I would like to tell you about my impressions, my sports, my work, and about everything I saw, beginning from the moment when I entered the cabin up till the landing.

Since daily routine does fully occupied with preparation for flight, mental work tasks of work, rest and diet took up the rest of my time. I was in high spirits. I never lost confidence in a successful landing. The flight and landing were excellent. The capsule, the ship's cabin, the equipment, in case of necessity, of the capsule, its descent by parachute, and the removal of all that is necessary for returning the



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"Hands off" ILS approaches for helicopters

A major advance in utility and performance of rotary-wing aircraft—fully automatic instrument landing approaches—has been achieved by the U.S. Army and Sperry Phoenix Company. This is the latest in a series of important Army Sperry achievements in advanced flight.

A twin-engine Army H-21 Shawnee, equipped with the 25-pound Universal Automatic Flight Control System developed by Sperry with the U.S. Army Signal Research and Development Laboratory, has made "hands off" ILS approaches. The system took over automatically the complex fire-control management of the aircraft even maintaining

critical fast-speed instrument approaches made in an altitude of 30 feet—well below established weather minimums. This advance is a key step in solving traffic control and other problems of modern helicopter operation.

The Army Sperry system also "hands off" the helicopter to the aircraft's VOR ground station network for automatic aircraft navigation. Using rated the AN/ASW-12 (V) system, it can provide precise automatic control of rotary-wing aircraft of Army aircraft, both present and future. Designed around a universal 300-pound computer-processor (a self-contained servo system) it offers a

variety of navigation "packages" to achieve any desired degree of flight automation.

With satisfactory results reported in earlier trials, the new system is in production for the Chinook, AH-1 Mookaw, HC-13 Choctaw, and HU-1B Iroquois. As an example of precision landing approaches, perhaps the best visual picture instrument control of rotary-wing aircraft of Army aircraft, both present and future. Designed around a universal 300-pound computer-processor (a self-contained servo system) it offers a

SPERRY

SPERRY PHOENIX COMPANY, DIVISION OF SPERRY RABO CORPORATION, PHOENIX, ARIZONA

safely, all this created a very good impression and kept up excellent spirit and morale.

While in the roles I passed all sorts of noise coming through the boosters body that the last projectiles were in progress, and I maintained communication with the control center. After some time the message "Get off" was given to the landing gear. The landing gear was deployed and it went up properly during the last second. Gently the speed begins to build up which we felt through experiencing stresses. When landing was completed, Vostok 2 was not affected, landing was easy and everyone was happy with the landing gear operation. This could be detected through variation of noise and a ground contact with the ground was monitored correctly only. I reported about my conditions and about the further operation. After the landing was pronounced, I could see the marks for the first landing gear and the second one. The landing of the ship was successful.

Suddenly the nose dropped, should fell and I had the intuition that I was assuming a head down position. The sheets that surrounded me seemed to float up and only one or two minutes later they returned to their place.

The first time around the earth began I pulled off my glove, opened the helmet and checked the equipment, gazing at the earth through the porthole. The earth was very freely可rotatable. I turned the radio on and off again. I turned on an alarm clock, still in the same position as the alarm clock of Vostok 1. At this time I was informed by earth that the orbit time space craft Vostok 2 was put into was close to the calculated one.

On crossing the earth's shadow, I noticed that the earth's shadow moved in the same direction as the planet moved. The shadow was a hardly noticeable, bright edge. While emerging from the shadow I watched the earth (it), then the blue border, purple band at the very center and black band (dark shadow). I looked at the earth from a lighted side which, traveling in the earth's shadow, our planet did not give the impression of a black gap. The earth appears to be covered in a gray sheet. And what is more if you look at it more attentively you can notice the earth's shadow.

On crossing the earth's shadow, I began to control the ship manually. The ship readily responded to my handling of the controls, and after several minutes it was controlled completely.

Just at this time Vostok 2 was approaching the horizon. After a few seconds of clouds, yellow and brown seeds were quite distant. The Mokawak was close and stood not clearly against the background. The clouds, however, began to grow gradually and soon it became difficult to see anything. I got out of the seat and took position at the point of the earth's closest approach.

As depended on the program, during the shade flight I monitored, can communicate with the ground, effected visual self-observation, carried out physiological and pathological tests. No disorders were detected.

The first time passed then the second. When the ship was in the third orbit, 14.1 to 42 min. after launching, I had done

the first of food consumed in space probably the most as of those eaten on the ground. However, the food was not particularly bad. When I opened a tube, containing black-coffee paste, I opened a slice of the bread, which was exposed in front of my nose, and I had to leave it.

After about 15 minutes the time for sleep arrived and preparing how the equipment was used, my eyelids for the second time were 1 hr 20 min., and the next time it was 1 hr 30 min.

In the fifth time I reported the physiological tests again.

On the sixth turn I was so fully concentrated on the work that I interpreted that the air-conditioning equipment was operating perfectly. The temperature

was 20-21 deg. C., relative humidity 70%. At 17 hours I finished time, while as the next day I had to sleep, while I was flying over the Gulf of Finland. I was fascinated by the beautiful pale green color of the coastal waters which further were changing into a greenish gray color of the sea. While flying over Washington, the capital of the United States of America, I made my best efforts to the navigation project. I thought that after several months I would be flying over the capital of the Union of Soviet Socialist Republics. I covered the distance between Washington and Moscow in only 10 hrs, the first time I made my eyes close together.

So this night I used several antibiotics



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teeth open, and after tying the satelite removal apparatus, I started my fuel for the day. I had to put in 100 octane Merlin. I should not have put in the most actually available, as I felt a certain degree of fuel tank in the fire symptoms of knock ness.

It was really felt during straight away and the fuel tank though this solution did not affect my efficiency.

Before moving to 1/2 of all fuel my tanks which seemed to be suspended in air and fell into a light shadow. At first my sleep was not sound enough, but then I slept, the next morning I was up at 0530. I made a check of this reading in the program. My sleep was good, without dreams, in contradiction to each condition I didn't feel the necessity of having from side to side.

Having worked in the darkness orbit and with the cold winds of a solar storm, it didn't understand at first what was going on. But then I induced something of sleep and began to establish radio contact. After determining the coordinates and sending them to earth, I found that I had passed over the last populated section of the moon had started.

When I was flying over South America red aggressively over the Atlantic Coast of Brazil, I detected two phosphorescent spots at the side of sight. They were approximately 100 miles apart. The phosphorescent spots were very bright. They were positioned one below using them to determine the course of the flight. I had the opportunity to see no moon, no stars—no moon—but see these spots. Outside the atmosphere it looks somewhat more darkly off-white. At 0530, I could see the moon look at 4 from the earth. As the stars they seemed to be brighter, and these was some of the twinkling stars as we to track started to.

When I was flying over the South Union I saw some stretches of cultivated land.

Then at one moment along the earth and building assignments operated by the

program as casting in the earth's shadow at another, I executed the fractions, although not in the same.

In the next several orbits I started to pass over the desert. I made several of the objects I had used in flight checked the survival equipment prepared the space suit.

The survival equipment was checked for fire locking and descent to the ground was started on.

At 9:30 100 miles the survival module was cut off. Re-entering we fell through the zone, through disappearance of the weightlessness condition as the atmosphere came in. I made a check of the same on passing in front of the port hole. From this it looked like fluorescent points and fluorescent coated spots.

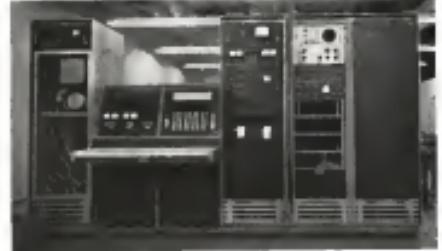
Cloud coverage had a whitening effect upon my visibility, but the atmosphere was also a factor had decreased through the fact that I was returning to earth.

From other reasons, though waiting somewhat the registration which shows the status of the position during descent, I left the portholes open and was recovered in the atmosphere. The atmosphere had a highly radioactive particle of a strong purple color surface. The portholes began to turn yellow, the glass acquired a like coating.

Cloud started to increase. My body temperature was very high. However, we were not detached. Interference through somewhat hampered—entered quite deep sun area. Cloud started to show gradually. The sound resembling the noise of a jet engine reached my ears. The ship was approaching the earth's atmosphere.

The landing position directly land, fall into option. Several seconds later I hung poised on the robot arms. I took in fast field spreading below, streaks of light. I saw a culture and a town that appeared as if it was a small town with a main road and two big cities in the distance.

The ground comes nearer and nearer. It seems that I am going to land these re-



Nimbus Control Station Fabricated

Ground station for NASA's weather satellite Nimbus control station will have satellite command function in a satellite power system and is designed for mobile or fixed site development. Mason includes self-shielding equipment. Three ground stations and seven satellite receive systems weighing 16 lb and consisting of housing and coordinating elements capable of controlling 128 auxiliary devices in the orbiter. These are being fabricated by California Computer Products Inc., Downey, Calif., for NASA.

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Hamilton Standard White Room being used to assemble and check out propellant transfer units for the Air Force Titan II missile program. The facility is absolutely isolate for test and assembly of turbines and components which must be produced under extremely clean conditions.

White room for the Titan II propellant transfer system

Development and production of equipment for handling extremely volatile missile fuels—like the propellant transfer unit for Martin Marietta Corporation's Titan II—demands a contamination-free environment, controlled to within 0.3 microns. Hamilton Standard's new White Room, especially designed for building missile fuel handling systems, even surpasses the exacting requirements of a hospital operating room. It provides 900 square feet of ultra-clean assembly and testing equipment. Detailed construction drawings and strict control procedures will guarantee conceivable conditions always.

Building a propellant transfer unit for the Air Force Titan II missile program is just one of several recent GSE projects in which extreme cleanliness has been a major consideration. This package unit is skid-mounted, electrically powered, manually controlled (with auto-

matic safeties), and capable of pumping either fuel or oxidizer. Performance is gauged by its ability to absolutely contain toxic fluids and vapors. To meet these requirements, Hamilton Standard developed important new concepts in sealing and gasket reliability.

The White Room's capabilities work hand in hand with other key controls to provide manufacturing quality, functional reliability, low system cost, and on-time delivery of all Hamilton Standard Ground Support Equipment.

For the solution to your missile fuel handling problems . . . or any GSE assignment from aerospace components to complete weapon support system, phone: Manager, Ground Support Equipment Department, Hamilton Standard, Windsor Locks, Connecticut, or write for illustrated brochure.

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the return . . . I touch the switch which turns heated air out from it on the field. The flight was uneventful.

Flight Results

And now, with one reservation, I shall describe the results of the flight.

During the flight, the radar was not in use (constant motion observations).

Ground systems caused no problems from the stop in my condition and enabled my hotel stay and breathing. Electronic troubleshooting was effected on a continuous basis.

The medical observation results indicate that the exposure adapts rapidly to the overwhelming conditions of space flight.

From the point of view of our scientists and physicians, the measured conditions of the flight were not considered to be adverse to future loads and stresses caused by the flight; i.e., they were adequate.

Thus, if one observed the pulse condition, one noted that in its rate prior to boarding the ship was 72 beats a minute. After one hour of the acceleration effects, the pulse quickened by only 18 beats, it increased from 90 to 108 beats. This actually is easily explained. Undoubtedly we come across the emotional factor here, the so-called "pace" lowering state.

To my mind, it is significant that at the moment of the end of the flight, at the moment of the acceleration effects, the pulse quickened by only 18 beats, it increased from 105 to 118 beats. At the beginning of the stage, and then increased in 104 beats when the ship was being put into orbit.

When the ship was descending, the pulse was at 100.

As the flight progressed, the pulse rate

SWEDEN AND NORWAY CHOOSE SELENIA ATCR-2 AIR TRAFFIC CONTROL RADAR



After a detailed analysis of competitive radars by the technical and operational experts of Sweden and Norway, SELENIA radars were chosen. SELENIA ATCR-2 dual-channel air traffic control radars are to be installed at Stockholm (Bromma) and Oslo (Fornebu) airports. These radars are ideally suited for coping with today's traffic problems. Long-range area control involves detection of even small jet aircraft. Close-in approach and departure control involves high data-rate and extremely high target visibility within heavy fixed radar clutter. The SELENIA radar solves both requirements.

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MINIMIZING of transistional trouble equipment will have built-in self-test provisions to prevent ground checkout on the ground and in the air. Equipment 3 (left) contains ATC transponder, marker beacon receiver, omnirange and glide slope (packaged, glide slope receiver, omnirange receiver and testing lead). New line makes datum this summer.

Bendix Builds Self-Testing Avionic Units

By Philip J. Klein

BENDIX-BECKER Radar's new generation of navigation and instrument approach equipment will feature built-in self-test provisions to enable manufacturers and pilots to check equipment especially quickly on the ground before takeoff and in the air.

The decision to adopt this integrated self-test feature throughout the new line of Bendix solid-state avionics equipment, stated as a goal starting this summer, is based on experience with the DMA 12 Doppler radar and NVRA 12 navigation system in which Bendix has refined the technique.

The new solid-state equipment is under consideration by several major airlines for use on the Boeing 727 and is believed to be a major contender for the Air Force's Lockheed C-141 jet cargo transport, now under development.

Although the new line is somewhat smaller and lighter than predecessor equipment, the major emphasis has been to increase operational reliability in service. From an airframe viewpoint, the new avionics equipment should be around 10 percent more reliable than previous models, where individual parts are too small for conventional radio tube installation. This has led to an integrated navigation package configuration which will be used for the first time in the new Bendix line and competitive equipment. The navigation receiver, an assessed measure receiver and the glide slope receiver will be contained in a single short 1-ATR case.

Studies made by Bendix, an attitude measurement, a liquid, and infrared, indicate that various tubes and line are major cause of avionics equipment failure, as

ending to George W. Chevalier, manager of avionics products.

Field data also reveals that approximately 10% of the parts of equipment removed from aircraft as defective show no malfunctions when they are returned to the shop for repair. This suggests that at least some of the parts are actually removed, possibly with unnecessary damage, in airframe flight.

Another explanation for these seemingly unnecessary removals is an entire aircraft type of fault, possibly caused by poor contact in a single unit at rotary switch, which was not repeatable (self-test) or able to return to its original function. The nature of the equipment malfunction, the service shop has to be able to find the trouble and the equipment may be reinstalled on an operating aircraft, only to have the fault reappear at a later date.

Improvement Program

Bendix has focused its reliability on trouble-free flight along three avenues:

- **Transistors.** Transistor and semiconductor devices are being used instead of tubes whenever possible. For example, the new RNA 12A navigation receiver, which is a solid-state receiver, the new NVRA 12A marker beacon receiver and the new DRA 12 Doppler radar are completely transistorized.

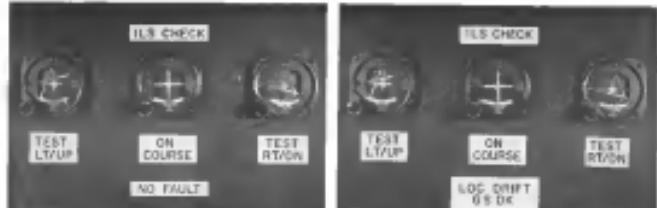
- **Minimized mechanical motion.** In the belief that moving parts such as rotary switches and relays, are potential trouble sources, particularly of the intermittent type, Bendix has removed all unnecessary moving and switching elements that eliminate the need for alarm and safety switches. The only moving parts, for example, in the new RNA 12A navigation receiver are the small servo motor and markers used to operate the radio magnetic indicator (RMI) in the cockpit.

- **Built-in self-testing.** The anticipated reliability improvement from use of solid-state devices and placement of using moving parts focuses attention on the need to return, if not eliminate, unnecessary motion. A new switch which delays a flight test by one or offset in airline operations and passenger satisfaction, whether or not the equipment has actually failed.

Bendix Radar first suggested the need for built-in self-checking provisions during the development of its DRA 12 Doppler radar. To maximize reliability the equipment is fully instrumented, except for the transistors output tube and two gas voltage regulator tubes, Hart thy.

But an overall complete a nearly 18-months study of VOR navigation receiver, aircraft, and the nature of the equipment used. On this basis, it might be expected to exhibit and a fraction of the wear-life between failure of a VOR receiver, which would make it use questionable at a greater altitude and for long cross-country flights.

The fact that a Doppler radar is a self-contained navigation system is an operational advantage, but with the resultant disadvantage that it performs many more checks before takeoff, unless special provisions are made.



CHECKOUT of ILS indicators and glide slope units test plots panel indicators. When test switch is thrown to left, test signal should deflect indicator needle up and left to first dot, when thrown to right, needle should deflect down and right to first dot. Left photo shows indicator needle position when equipment is operating right shows deflection when localizer receiver is inhibited.

and in the equipment. This provides up the need to hold self test provisions into the Doppler receiver, Chevalier says.

Bendix studies pointed up other conclusions, applicable to all types of avionic equipment. One is that any circuit added to provide self-test must be at least one order of magnitude more reliable than the equipment to be tested. This means that the self-test circuitry must be held to a low margin of safety, and that it should use two transistors and avoid relays whenever possible, Bendix says.

Additionally, it is desirable that the cockpit indicators which the pilot will use also be employed in using the equipment, especially, in that the panel displays in well at the black board in checked in the process.

Self-Test Circuit

The self-test circuit which Bendix devised for its Doppler requires the detection of only a single of circuit and approach to self test circuit, according to Hart. It generates an on/off, 4000 Hz Doppler signal at a 4.5 m/s intermediate frequency, which is injected into the local oscillator at the point where the remotely located antenna connects into the transmitter/receiver.

When a maintenance man or the pilot pushes the test button, the test signal is injected and should cause the panel's pilot indicator to show a ground speed of 600 ft/s and a drift angle of 20 deg N/S.

The operation of the transistored navigation computer can also be tested by the same means. A typical flight path can be set up and the Doppler test signal allowed to feed into the receiver for, say, 10 min. At the end of this period the computer calculated air craft position can be compared with what it should be on the basis of a 10-min flight at 600 ft/s with a 20 deg drift.

The self-test provisions do not per-

mit the test of the Doppler transmitter, the antenna, or the receiving detector diode in the antenna. However, Bendix has designed a small hand-held unit which a maintenance man strapping onto the antenna arm at each of the four antenna radiators to measure the level of energy being transmitted.

Federal Aviation Agency has authorized Ward Aerospace to develop flights on evidence of Doppler self-test provisions as established by the board of inquiry and the use of the self-test losses.

The Bendix Doppler currently is evaluating a failure rate comparable to that of a VOR receiver, despite its greatly increased complexity, according to a recent VDR report.

An important byproduct advantage of the built-in test circuitry has been pointed up in connection with the Doppler system. When formerly a test returned to the cockpit display might easily be flagged as questionable, leaving the test operator to interpret the results of the self-test and then to cause the local lead at test function to issue a pilot- or line-moderator personnel to provide more specific data on the malfunction.

Defines Trouble Area

For example, if the Doppler test panel indicates a panel indication of 400 ft/s instead of the expected 600 ft/s, but does give the correct drift angle, this information is most valuable. To those operators who have to interpret the trouble area, the cost of adding the built-in test feature would represent a very small fraction of the cost of the equipment. When the additional cost is only 1-2%, the self-test provision really will be incorporated in all production units. For the various bonus receivers, because of its inherent simplicity, the test circuit is expected to add about 5-10% to the unit cost, and will therefore be of limited use in an optional basis.

The self-test provisions do not per-

mit all as a small printed circuit board which can be plugged into the basic master bonus circuit, if desired.

In the VOR navigation receiver, the self-test circuit checks the operations of the receiver and auto-converter, using a signal from any VOR station within range. In normal operation the converter determines the aircraft's bearing to the station by comparing the phase of two signals, one a 10-cps reference signal and the other a 10-cps frequency modulated on a 9,000 cps carrier. The test circuit expects the 10-cps variable phase received from the receiver VDR into both channels, giving a phase angle of 90 deg, so that the pilot's RMI indicator would display a bearing of nine deg to the station if the aircraft is operable. When the pilot sets on a bearing of zero deg as his course heading selector, the test circuit could be used to indicate whether or not the receiver is operating properly.

The circuit can only check to assure that the receiver is operating, that it is properly balanced if the receiver is perfectly centered. The self-test circuit does not test for the operation of the local oscillator, but this is not considered to be a critical element. Since the self-test circuit obtains an signal from the various VOR stations, it also checks operation of the receiver and antenna.

ILS Test

The most critical aspects in the self-test approach portion of the navigation receiver are the radio altimeter, which determines the vertical position with respect to the center of the ILS transmitter and glide slope, according to Hart. In view of current emphasis on lower minimums for jet transports, Bendix believes it is particularly important that the pilot be able to check the performance and calibration of that circuit before he begins an instrument



When a giant thinks small

Lockheed becomes a prime source for memory devices—from tiny ferrite cores to entire memory systems

When you think of Lockheed, major aerospace achievements usually come to mind. But within the giant Lockheed Corporation is a complete unit where success was attained by the company's ability, also, to think small. The result: in record time the Lockheed Electronics Company has become a prime source of tiny computer and data processing components for industry and defense.

In an exceptional example of vertical integration, Lockheed Electronics is now producing a broad line of memory devices including single and multi-bit-per-cell, memory planes, stacks, and systems; printed circuitry, widely used in entry and computer modules. This under-one-roof operation has earned the Lockheed a reputation for quality, on-time delivery and versatility.

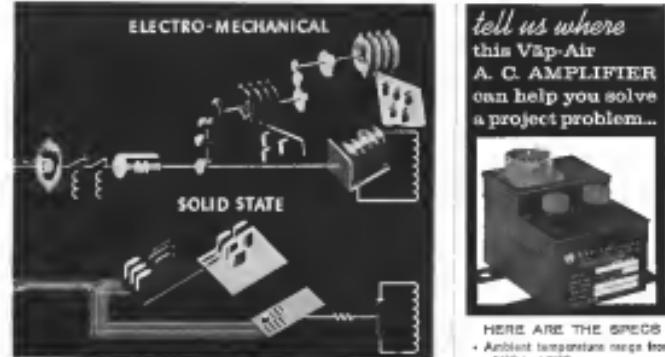
Lockheed's inventive designers, among other accomplishments, have achieved outstanding results in the development and manufacture of multi-aperture cores which permit high-speed, non-destructive memory readout.

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The Avionics and Industrial Products group of Lockheed Electronics, 6201 E. Randolph St., Los Angeles 22, invites you to investigate the company's virtually integrated facilities as a "single source" of these quality, mass-produced components and sub-systems. Lockheed Electronics is also a gateway to several advanced memory engineers and technicians who work for Lockheed.

LOCKHEED ELECTRONICS COMPANY
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SOLID-STATE circuit switching and timing will be used in new Bendsix test, and in other competitive equipment. It should find use for relay modules and other which requires power to be source of instability. Improved stability is a major objective in new design.

approaches. This is one reason the ILS self-check circuit generates as even test signal rather than alternating between the location and glide slope beam boundaries which permit high-speed, non-destructive memory readout.

When an aircraft is in the center of the glide slope/locational beam, it attains 99° and 180° signals of equal amplitude when it crosses over to the other in flight, depending upon which side of beam center the aircraft is flying. The test signal which Bendsix uses consists of a 90° or 180°-qua tone, generated at a small frequency overdrive.

When a test switch is thrown to the left, the test circuit generates a 180° tone of constant amplitude which is reflected onto the horizontal fillet section of the glide slope and locational beam. If they are functioning properly, the glide slope will be in the cockpit will move up to the first dot on the instrument, while the locational needle moves to the first dot on the left.

When the test switch is thrown to the right, the test circuit generates a 90°-qua signal which should cause the glide slope needle to move down and the locational needle to move to the right to the first dot on the instrument face.

By observing the action of the two needles above the switch or its hold position, a maintenance man or pilot can draw a number of conclusions about the condition of his ILS receiver.

- If one or both needles fail to move, one or both needles are inoperative.
- If deflections are not equal on either side of the neutral position the com-

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150-hour endurance test included 10 hours of 100% power output hot day conditions, 45 hours of 100% maximum continuous power. There were no shutdowns for engine problems.



Three aft-mounted JT8D's will power the Boeing 727. This compact jet is designed for profitable operation over low-density routes with 100-to-1,200-mile stage lengths.



Turbofan JT8D features 13-stage compressor, 4-stage turbine. Compression ratio is 15.6:1. The 14,000-pound thrust engine replaces powerplants JT3 and JT4. Specific per-

Pratt & Whitney Aircraft to deliver first JT8D turbofans for Boeing 727 flight tests

Sometime soon, three aft-mounted Pratt & Whitney Aircraft JT8D turbofan engines will power the Boeing 727 jetliner on its initial flight—little more than a year after the engine ran for the first time.

Such swift progress is possible because the JT8D's basic design has been proved by more than 25,000,000 JT3 and JT4 flight hours. Capitalizing on this experience, Pratt & Whitney Aircraft has developed a lightweight, high-efficiency powerplant with 14,000 pounds thrust. The JT8D achieves this advanced per-

formance through a design concept already familiar to operating personnel at 34 world airlines.

With its trio of turbofans, the 727 can operate at full load from 5,000-foot runways. This 550-to-600-seat jetliner is designed for profitable operation over low-density routes with 100-to-1,200-mile stage lengths. To date, United Air Lines, Eastern Air Lines, American Airlines, Lufthansa, and Trans World Airlines have ordered a total of 127 planes. By 1968, the 727 will bring the benefits of jet travel to new cities throughout the world.

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Now . . . SPERRY packs 10 W output, 60 db gain into a 10 cu. in. TWT

Because of the space age demand for smaller, more rugged components with outstanding performance characteristics, the new STX-186 is now available on 60-day delivery from Sperry Electronic Tube Division.

The new X band traveling wave tube is ideally suited to the rigors of aerospace application. It delivers a minimum 10 watts of CW output across X band, at gain levels up to 60 db. Yet it is only 10½ inches long, weighs only 12 ounces, and occupies only 10 cubic inches of payload space. Rugged metal-ceramic construction enables the PPM faced STX-186 to withstand the shock, vibration, and survival extremes of the most demanding aerospace environments.

Designers can make maximum benefit from the tube's small size by adopting mounting and cooling arrangements to meet specific environmental demands. Coolers may be air, heat sink, or liquid.

BROAD APPLICATION POSSIBILITIES

In addition to its small size and physical ruggedness, the STX-186 boasts per-

formance characteristics that open a broad range of application possibilities.

Across the entire band of 7 to 11 GHz, this new TWT delivers a minimum 10 watts of CW at up to 60 db gain. The dynamic range of broadband signal amplification exceeds 25 db below saturation. These characteristics make the STX-186 ideally suited for rocket, avionic, and survival applications in radar, magnetometer, ECM, or communications systems.

IMMEDIATE AVAILABILITY

Sperry is now producing the STX-186 in quantity, and limited numbers are available within 60 days of receipt of order.

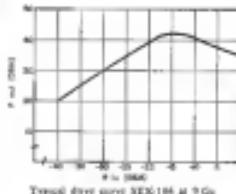
A NEW TECHNICAL BROCHURE, WHICH DESCRIBES THE CHARACTERISTICS OF THE STX-186 IN DETAIL, IS NOW AVAILABLE. FOR YOUR FREE COPY, WRITE TO SPERRY ELECTRONIC TUBE DIVISION, SEC. 133, GAINESVILLE, FLORIDA.

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CERAMIC SUBSTRATES are loaded into loops of machine, left, which prints circuit patterns at Antennae Research Center. After screen printing, substrates pass to belt through drying oven and are removed at rear of oven, as shown in background of photo. Right, research engineer checks under optics printing on unheated substrates; patterns are developed at Antennae Division of North American Aviation. Computer controls a masking system to control screen printing of patterns.



Screened Circuit Processes Mechanized

By Barry Miller

Antennae, Calif.-Controlled, mechanized processes for integrated circuits using high quantities of microelectronic circuits which can be used in its future military, aerospace, and commercial electronic systems are being developed here at the research center of Antennae Division of North American Aviation.

Like many other systems and equipment manufacturers, Antennae is seeking to reduce the problems of manufacturing reliable and cost-effective printed circuit boards. It is looking at several microelectronic approaches which lead themselves to increased automation in the belief that automated processes will lead to high yield, economical manufacture of microelectronic circuits. One or more of the approaches being investigated—these include screened thin oxide and evaporated film substrates as well as integrated semiconductors—may eventually go into the company's major military projects depending on testing and reliability.

Reliability emphasis

With the emphasis Antennae places on reliability, particularly in its Minuteman ICBM guidance and control system program (AWW Oct. 19, 1959, p. 69, Dec. 11, 1960, p. 90), it is not surprising that the company is step stress testing thousands of lead-capped microcircuits coming off its mechanical development process line here as an

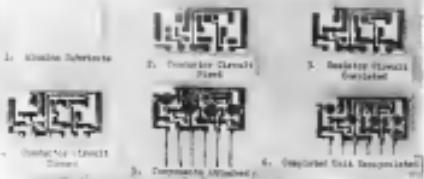
effort to determine circuit reliability.

The parallel mechanized process line now in operation turns out high-quality patterns by the centimeter. One of the generators processes is known as stamping, in which a mold is vibrated at a selected frequency to form a desired pattern. The patterns are separately printed through a screen printing machine which has a stencil printing machine which is the central step in circuit processing. The patterns are printed on aluminum, or ceramic, substrates, presently 14 in. by 2 in., fed to the molders by a preformed hopper or magazine.

After the patterns are printed, the substrates are covered by a resistive belt through a low temperature furnace (1,000°F) that sets a fix for the resistor and conductor patterns in place on the substrate.

Antennae plans to install stamping at the end of both the oven and furnace so circuits can be fabricated without human participation.

The line can turn out screened microcircuits at a variable rate from 30 per min. to 120 per min. The lower figure appears preferable for optimum control. The entire process, in



SCREENED process steps in preparation of screened substrates at Antennae are shown. Substrates are 13 in. x 3 in. Coating film is thicknessed on the flaps composed of 144 nozzles, on 3.2-oz. ceramic substrate.

Turning theory into hardware

Technological breakthroughs are almost an everyday occurrence in electronics. Everywhere we see many new scientific discoveries being turned to the service of man. Hughes is one of those companies whose obligation is not only to form these theories, but also to visualize how they might be applied. And then to make that application—both in man's defense and in the betterment of his life.

Today, Hughes technology is being applied in over 500 projects, programs and studies.



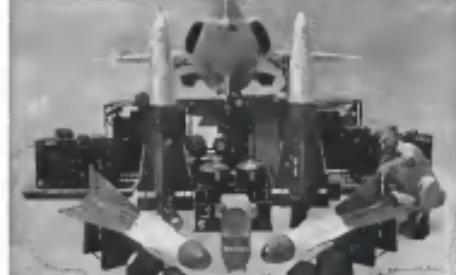
"No-rock" radar

Aware of the limitations of conventional Loran, a system of 100 stations, Hughes pioneered a technology where the beams are polarized. Electronically. Based on land or aboard ship, Hughes' "no-rock" radar can detect and identify surface and subsurface targets, keeping fleet efficiency on hundreds of targets. Even more advanced Hughes radars, which search hundreds of miles of sky, are now on operational duty.



Polaris missile brain

Through the application of its advanced manufacturing technology, Hughes is now a leader in the field of missile guidance systems. Guidance system for the U.S. Navy's Polaris missile. It is one of the world's mightiest, most reliable forces for freedom.



Modern Falconry

In the late 1950s, airborne interceptors with 10 radars. Yet, in a few years, U.S. Air Force jet interceptors with twice the electronic warfare, missile systems armed to kill. Helicopters. Today, in high intensity flight, they have joined our aerial ground-air defense weapons. Hughes—the leading builder—has airborne thousands of control systems and well over 30,000 infrared and radar guided Falcons.



Satellite "switchboard"

Soon NASA is scheduled to launch the first of a series of communications satellites, each internally synchronized and positioned in a 22,300-mile high synchronous orbit. Just three years ago, Syncom satellites could relay only 100 messages per second. Today, with the help of Hughes' highly developed message switching system—developed and built for NASA, this Syncom system could add a new dimension to man's communication with his neighbors.

at Hughes

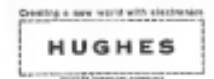
A few are shown to illustrate: Completely new technologies which are creating new devices... Major improvements in existing technologies... Advanced manufacturing technologies which produce more reliable hardware for duty in this world—and out of it.

More than 5,000 Hughes engineers help create the theories. More than 20,000 other skilled Hughes people help translate their work into practical hardware. Together they are helping create a new world with electronics.



Boxed air defense systems go anywhere

An integrated system to encompass aerial, ground and mobile air defense control systems can be easily transported in a single unit. It can be rapidly installed. "Operate Once" plus comprehensive references for individual control of U.S. Army and Marine Nike and Hawk missile batteries.



Ion engines for deep-space probes

Hughes research into the theory of electrical propulsion has led to development of ion engines which are called the "silence" source of power for deep space travel. Built for NASA, Hughes' ion engines power an ongoing tour to the outer reaches of the solar system. The ion engines are subminiature ion accelerators for use in deep space within the solar system.



Microelectronics

Today's chemical engineer must provide the "precision needed" for that highly sensitive research in controlled environments. Result of Hughes' microelectronic computer technology is the "precision needed" for the "precision needed." Automatic Testers have a built-in "intelligence" of 1 million bits of information. This capability is now in the U.S. Air Force's "precision needed" to check out every F-106 aircraft in less time, with greater accuracy, at less cost.



Missile checker

Today's chemical engineer must provide the "precision needed" for that highly sensitive research in controlled environments. Result of Hughes' microelectronic computer technology is the "precision needed" for the "precision needed." Automatic Testers have a built-in "intelligence" of 1 million bits of information. This capability is now in the U.S. Air Force's "precision needed" to check out every F-106 aircraft in less time, with greater accuracy, at less cost.



Freeway at 30,000 feet

every ten minutes a scheduled aircraft speeds along this lofty highway. It may be Britannia or Boeing 707, Viscount or Vanguard, Argosy, Friendship or Comet—but whatever the aircraft, its aids to safe flight and punctual arrival are likely to include SMITHS INSTRUMENTS. Right round the clock, SMITHS are helping to guide traffic along the world's air routes; helping thousands of aircraft to fly fixed courses at fixed altitudes, meticulously maintained by sensitive yet sturdy equipment; helping them to cover at least two million miles a day.

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The SEP is the Avionics unit by now 200 of the world's aircraft and air forces, chosen for its outstanding record of performance and unequalled reliability and proved over more than a million and a half hours in service. The SEP is the simplest of the BAE/ESI Avionics System, and will form the basis of the first automatic landing system due to go into regular operation.

It is logical that the SEP's has been chosen for the Trident, the first civil aircraft intended to perform regular automatic landings.



lasting 5 min, passing through the open and 12 min, through the housing, takes less than 20 min for an individual circuit. Minimum line width of the patterns are 5 mils (plus or minus 2 mils) related to a maximum of 2 mils, according to Spec 1. Goffin who handles continuous process development here. Goffin's previous was a special engineering manager at Avtron Corp., which had done earlier work on aircraft connectors.

Conductors and resistors of different ohm values are mounted on the substrate in separate locations. A changeover from one to the other, or a replacement of one for the other, is a replacement of the individual pattern, takes only a few minutes.

After being mounted, the connector is checked for solderability and adjusted upwards to proper solder by an electron process which removes part of the sensitive material. A pulse-adjusting technique also is used for connection.

Tolerances of certain pads on the developmental line have a sigma value of 35% when sigma is defined as the mean deviation from its intended or set point of a bell distribution curve of the fabricated master values. The sigma value would 65% of master fabrication

Printed Film Use

Two different types of printed film are used in common in the small aircraft pattern. This is a surface mount and available in densities ranging from 100 to 1000 ohms/square, the other is a glass or ceramic. The composed of metal powder with a ceramic base that is quite opaque for high temperature, short duration resistance over a wide refracting absorption range.

A steel aircraft capacitor capsule is under development but has not yet yielded capacitor leads that about 100 picofarads. To get the maximum benefit of circuit components and conductor which can be refined by the much more rapid working process, circuit boards have to be designed to minimize use of inductances, high valued capacitors and will employ direct and node coupling between circuit.

Structure thus requires the printed line to be moved from the laboratory into an Avionics factory.

Once the conductor and their resistor patterns are separately screened and fired on the substrate, the connection are dry soldered, and additional components such as transistors, diodes, surface capacitors, are soldered or cemented bonded to the substrate in a final step. Materials are cleaned in a series of solvents and ultrasonic. Step processes, including temperature and lead-free conditions, to be followed later by humidity and temperature shock tests, are

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Located near Phoenix, Arizona, and Peoria, Illinois, the sites are in constant use by Caterpillar's 1300-man Research Department. Once a basic design has been ap proved and a prototype developed, equipment is subjected to a series of rigorous tests. Through modern instrumentation, performance data is quickly obtained and evaluated.

Mobile instrument laboratories, like this dynamic measurement van, allow Caterpillar researchers to probe deep into the heart and liver of machines.



In actual field operation, the van's crew is putting Caterpillar's mobile, rubber tired eight-ton GOER through a strenuous test, simultaneously measuring 16 different operational characteristics.

In addition to the comprehensive proving grounds facilities, Caterpillar maintains an extensive field testing and research organization whenever Caterpillar equipment is used—from baking deserts to arctic ice shelves. These experienced specialists work with other Caterpillar engineers and manufacturing people in every stage of equipment development—from basic concept to final manufacturing. It's all part of Caterpillar's continuing program for the development of new concepts in military vehicles, their components, and power packages.

For more information, write Defense Products Department, Caterpillar Tractor Co., Peoria, Illinois.

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SCRATCHED MICROCHIRTS are shown after certain patterns have been severed. Left, being tested in a belt through the driving area. Right, ceramic substrate ceramic microcircuits are being removed by extraction belt from high temperature firing oven. Subsequently, resistance values can be adjusted, additional components—diodes and transistors—can be soldered or thermal bonded to the substrate, and the entire substrate then encapsulated. Automatics may be present later to facilitate microelectronic parts in high quantities.

being reinforced with screened circuits. Distribution of measured failures is plotted against stress.

In daily tests of screened circuit samples of 700 circuits, Autonetics found through step-down testing for periods less than 8 hr that carbon unmetallized resistors are less susceptible to damage by heat than comparable Microtron resistors. Reliability comparable to that achieved by Microtron resistor is expected for longer duration. Strategic life over long periods, within the tolerance of present testing, should be about nine at Microtron junctions.

Hardware Tests

To test screened circuits in an actual operating environment, the Inertial Navigation Division of Autonetics redesigned and constructed an Army container, or green container, using screened circuits. The original equipment, including single in-line green, power supply fan and thermistor, weighed about 11.5 lb. The Army asked for short time delivery of a more portable unit, with capability of providing an azimuth in direction to a point of use within a 10-sec period.

By reducing size and weight on a number of items, Autonetics developed a demonstrating unit weighing 1.8 lb. (the new unit battery accounted for another 5.5 lb., called MARBLE (Microtron Autonetics Resistance Equipment).

The dimensions of the assembly was reduced from 14 lb. to 0.5 lb. by the use of the ceramic-based screened microcircuits with discrete active components and capacitors added.



Other appreciable weight reductions were made possible by the use of a smaller thermistor, a more compact power driver, model green, a more uniform circuit resistance.

For this application, two resistors were mounted above a metal insert which provides for insulation, masking, and the entire unit, or chip is mounted on a ceramic substrate and then bonded to a conventional printed circuit board. As with the metal probe, a lead inserted into the board and soldered from the rear. The

electronic portion of the circuit, including modulator flip-flops, ring counter, mix, mix and mixer amplifiers—a 16-pole power supply, are contained on twelve such chips mounted on the circuit board. In this case, chips are not encapsulated.

The MARBLE unit is being evaluated under varying temperature conditions in the Army in units of Ft. Sill, Ft. Belvoir and in Alaska. The unit was cold tested at -55°C for 8 hr, without cold failure. It worked well down to



RESISTANCE VALUES can be adjusted by cleaving technique shown in our last



VIBRATION NEWS

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MB's T-388 Automatic Equalizer cuts equalization time to 5 seconds...

Production random vibration is now practical with MB's completely automatic spectrum equalizer. Set up time is shortened and equalization reduced within 5 seconds. Savings in test time and labor for acoustic and vibration manufacturers can easily reach many thousands of dollars per month.

Operation of the T-388 automatic equalizer is extremely simple and can be readily handled by two technical personnel. A flat or shaped spectrum is easily programmed on the spectrum control panel by setting the slide waves. A template of the spectrum can be used for the



Operator of unit 1000 (1000 cps to 2000 cps) in test for the T-388 Automatic Equalizer.



setting as shown above. The equipment does the rest.

The T-388 also provides higher test accuracy and versatility. Equalization is with all the automated and sophisticated automatically compensated filters, from fundamental frequencies and changes in amplitudes. Narrow frequency range is 15 to 2000 cps to 25 cps bandwidths, any 2500 cps bandwidth can be selected between 15 and 18,000 cps by simple front panel selection.

Other unique features of the T-388 Automatic Equalizer include:

- Spectrum analyzer has 5 types of analysis: 1) gain/loss, direct

reading in g²/cm²; 2) visual display on scope for quickness monitoring; 3) permanent record of test using X-Y plotter.

• Highly accurate equalization through the use of 16 distinct sets of narrow bandwidths (25 cps) covering a 2000 cps band.

A test laboratory equipped with the T-388 unit will not only save many hours of valuable test time, but will also be prepared for present and future test requirements.

For detailed information on the T-388 Automatic Equalizer write to MB Electronics, 992 Whistler Ave., New Haven 14, Conn.

Over 50 Multi-Filter Equalization Systems purchased by leading test laboratories

The following laboratories which the MB Multi-Filter Equalizer and its duplicate makes in the field of vibration testing has installed the MB Multi-Filter Equalizer in their vibration testing laboratories. To date a total of 50 units have been purchased by these laboratories. This is not for assignment of this type of equipment to all government and industrial laboratories, but merely to illustrate the unique advantages and savings of the Multi-Filter Equalization System to your test pro-

-100°, but at -65°F flotation fluid is the glyr通知 in wax. The power amplifier section will be reduced to microelectronic chips in the next version.

The intended microelectronic approach to the D-Ballistic Avionics was presented by Dr. Robert A. Atiles, vice president of research and development department here, at the first of several sequential steps he foresees in the company's adoption of microelectronics. "This approach, he says, potentially is less expensive than other micro-approaches and closer in time to potential use. An backlog for the first step in research engineers also are investigating a no code file system and evanescent storage in a secondary backup.

Integrated Electronics

The trend may be obvious in integrated electronics and beyond that some of the more sophisticated concepts of integrated electronics.

Atiles points out that the mission of the research department is to make available advanced technologies to other Avionics divisions to provide leadership in new systems. To integrate systems properly, Atiles and work in new equipment.

He cautions there are differences within the company about which will go to in microelectronics, but explains that most of the division is in accord with the R&D laboratories to accept one approach. Reliability and cost, with an objective failure rate of less than one failure in 100 million part hours, are dominant considerations as in the amount of storage, or growth in an integrated approach.

With regard to integrated circuitry actually incorporated into Avionics systems may depend on time and economic choice, he points out. What he reveals is the second step, integrated circuits, has developed surprisingly fast, he notes and a time difference between this and the first step may be diminishing.

Other Fixes

Advances currently in working with a large number of integrated circuit manufacturers, including Texas Instruments, Fairchild, Pacific Semiconductors, Motorola, Claude and Spagos, seem to indicate they are making significant progress. At the same time, it is establishing an internal semiconductor capability to continue these efforts and to explore future concepts.

The microelectronic approach, as approached, where Atiles and others are expected to have a considerable influence on the future direction of avionics research throughout the industry because of the company's large volume of military systems business, the large number of digital circuits in its equipment



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► Making it open to equipment and former manufacturers. Contract William Clegg, Annex 1730 18th St. N.W., Washington 6, D.C.

► New Role for Internal Guidance—New Air Force mapping and charting mission, the AN-USQ-25, to be used as jet transport aircraft for precision photo mapping and charting guidance can tell officials, will employ an internal guidance system to enable aircraft to fly precisely straight and parallel. Such system may also use a Doppler radar and inertial tracker in support to the internal navigation system to allow a planned or emergency, Mg. W. Clegg, told reporters. Recent internal guidance system of the Institute of Navigation in Washington, D.C. The AN-USQ-25 will be used by the Air Photographic and Charting Service of MATS.

► Texas Alcosat Subsidiary—Frederick & Muller, Los Angeles, developer and builder of information display systems and a subsidiary of Long Beach Vought, Inc., for the past year has now been completely absorbed by the parent company. New name will be Texas Electronics Display Systems plant. R. G. Murphy of L-F-V has been appointed general manager. The plant is making displays for several national data systems and recently completed installation of a display for North American Air Defense Command.

► Roads to Australia—New Australian News Series 60 integrated for jet fighters aircraft, expected to weigh less than 10 lb. and sell for under \$1,000, will be announced soon by Eclipse Power division of Bendix. Assembler will employ building block design, permitting addition of extra features and redundancy.

► Drawn to Engineers—Innometrics, company operating effort to expand rapidly from a year ago, based on the success of advertising space purchased for advertising in newspapers and technical publications according to figures released by Dentsch & Shulz, Inc., New York City. Figures for March show approximately 41% more advertising space than for same month in 1961.

► Airlines Industry on the Move—Field Service Center, Milwaukee, Wisconsin, Calif., in a division of the control systems, will open in Fall. Contract plan is to locate in South Fieldview, Mil. Work is slated to begin in plant production this fall, will employ 250 by end of the year. Other major industry developments:

► General Precision Equipment Corp. and Matsushita Electric Manufacturing Co. of Japan, have formed a new Japanese company Matsushita Precision Inc., with 10 of 100 doctors from the parent Japanese firm and four from GPE. The

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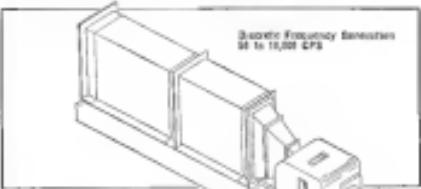
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Fast propagation, low signal loss and high temperature resistance—all in one efficient, lightweight cable!

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It combines all the outstanding advantages of PD air dielectric coaxial cables—low attenuation, excellent frequency response, uniform electrical properties over wide temperature variations and unlimited operating life—with even greater speed of propagation and, when used with a Teflon® helix, higher heat resistance.

The inner conductor is completely supported by a polyethylene helix within a commercially pure, seamless aluminum outer conductor. For applications involving

high temperatures (100° C-250° CL), PD Helical Membrane cable with Teflon® substituted for polyethylene is ideal.

PD Helical Membrane cable of 50, 75 and 100 ohm impedance is fabricated in 1000-foot continuous lengths and in standard sizes of $1/2"$, $1/4"$ and $1/8"$ diameters; other sizes from $1/8"$ to $1/2"$ on order. Complete cable systems, including ferrite窗口 and connectors, are available. Your Phelps Dodge representative will be glad to give you additional information. PD Helical Membrane cable is made by Phelps Dodge Copper Products Corporation at Yonkers, N. Y.

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new firm will produce three gyro stable platforms designed by General Precision's Resistor Division and a flight simulator designed by Link Division, for use with the 100.

• **Coaxial cable** will build elements of Atlas Motors' guidance system at a new leased 116,000 sq. ft. facility in Oklahoma City, Okla., the company's first in that state.

• **Varian Associates and Compagnie Fréquenti**, Thessalon-Houston, will form a jointly owned company to develop, manufacture and sell microwave tubes in the European market. Plan cell for an initial staff of 275, expected to double within several years. Mignot, president of the new firm will be held by the French company.

• **Cine Space Electronics Co.**, Houston, Tex., is a new firm for research, development and manufacture of television cameras and low frequency microwave transistors. President is Louis B. Mihm. Address: 5613 S. Rice Ave.

• **Signet** signed the Dotted Line-Magnavox contract award recently announced by various manufacturers.

• **Sylvania Electronic Systems**, Buffalo, N.Y.—\$373,000 Air Force contract to manufacture components for the AN/APN-81 precision Doppler navigation system.

• **AT&T Corp.** of America, Electronic Telephone Division, signed for four switch modules from North American Aviation's International Division for use in Simplipac nuclear reactor for space telecast use.

• **Vitens Electronics**, Silver Spring, Md., will provide Mercury tracking network with equipment capable to receive a wideband PCM (pulse code modulation) telemetry data under a contract worth by National Aeronautics and Space Adminstration.

• **Radio Engineering Laboratories Inc.**—\$100,000 contract from Air Force to build transponder, command and control system for remote path fire measurement facility.

• **Collins Radio Co.** \$712,000 Air Force award for construction of an transportable high frequency radio communication transceiver similar to 23 units delivered previously.

• **Espac Systems Division**, Cambridge Mass.—Contract in excess of \$1 million for development of data collection and analysis systems for geophysical short-cut oil detection from NASA's Goddard Space Flight Center.

• **Spacelab ICBM Detection**—Air Force awarded \$1.2 million for a special fiber insulated with helical metal tape cloth from Cope Cordwell Co. set as detector to confirm atomic-based ICBM threat. Four systems each in Mobile and Brooks and satellite launched surveillance; remote interception using passive homing.

NEW AVIONIC PRODUCTS

• **Welded circuit components**, a line of printed resistors and capacitors manufactured with leads made of different materials suitable for welding or soldering. Transformers are available within 10 ohms to 1,000 power stage depending on frequency and other requirements. Resistor range is value from 100 ohms to 17,000 ohms with dissipation up to 2 watts. Manufacturer: Microtron Components Inc., 120 N. Aviation Blvd., El Segundo, Calif.



• **Silicon rectifier diode**, MC685, with leakage currents in the picoampere range, is suited for ultralow signal applications. Will operate from -60°C to 175°C and is used to invert an inverted MIL-S-19268 open. Manufacturer: Microtron Components Inc., 120 N. Aviation Blvd., El Segundo, Calif.



• **Digital computer switch** provides many start to each of 180 positions now tested in extremely square wave. Switches are from 100 to 1000 pulses/sec. Contact resistance is 0.04 ohms; insulation leakage is 900 megohms. Power management is 10 watts and weight of the hemispherical switch unit is 24 oz. Price is \$1,200. Manufacturer: Link Electronics Inc., 1294 Morris Dr., Mountain View, Calif.

• **Digital modules** for spacecraft data processing systems operate at bit rates of up to 2.1 picosec from 3 to 25 milliwatts of power. Twisted pair data acquisition is a standard feature of the modules, which are supplied in 1-wire, full scale. Unit requires 45 in. of length, weighs 5 oz. and is designed for aerospace applications. Manufacturer: Tabor Instrument Corp., 107 Concourse St., North Tonawanda, N.Y.



• **Overdrive**, Model 111A, designed to provide low distortion 1 mil transients for electronic control supplies. Input can support up to 50 milliamp. Long term stability is 5 or 10 pp per week, overshoot is less than 1 in 10⁷. Model is priced at \$700. Manufacturer: Flexellet, Paseda Co., 1981 Page Mill Road, Palo Alto, Calif.



• **Low temperature solid-state**, suitable for liquid mounting and hence held by hand, requires only refrigerant electric to compensate for clamping and mounting. Operates at 100°K and is used for radio frequency applications. Radio action are available with field of view from 100 to 1000 nm and resolution from -300 to 100 with a 10°C accuracy for objects of known emissivity. Manufacturer: The Te Co., 415 E. Montebello St., Santa Barbara, Calif.





MARTIN/MARSHAL TITAN 1, shown above, left, following over-weather of a mobile site at Lowry AFB, is largest missile now in operational U.S. inventory. Above right, first stage is lowered into underground concrete launch site at USAF missile maintenance plant at Barksdale AFB, where they will be tested by Air Force and civilian engineers. Below right, underground貫道 (tunnel) entrance, one of several required for each site, connects missile site with underground launch control center. USAF Strategic Air Command recently activated control of two Titan 1 complexes at Lowry.



MISSILE ENGINEERING



AERIAL VIEW of USAF Titan 1 ICBM complex at Lowry AFB, Colo., shows a massive area of construction effort. White construction is completed. 17,186,800 sq. yd. of earth fill have been excavated and 2,647,800 cu. yd. of concrete and 542,000 tons of reinforcing and structural steel will have been utilized in constructing the ICBM complex.

SAC Takes Control of First Titan 1 Units

By Larry Boorda

DENVER—In less than one month, two weapon Titan 1 intercontinental ballistic missile squadrons have been transferred from the Air Force Systems Command, which constructed the launching complexes and is developing the missile, to the 45th Strategic Wing of the Strategic Air Command and declared operational.

Air Force officials say, however, that there is a definite difference between operating the missile and the task of having it do its combat mission. This difference is represented mainly in the level of maintenance and launch crew training and to a lesser extent by launch "bags" in the system which AFSC has the responsibility to control.

That such a difference exists is due to the principle of command position that is applied to missile systems by the Air Force. All elements that have had anything to do with development, manufacture, and operational deployment of the Titan 1 have been working together since the weapon was first tested more than 10 years ago. The Systems Program Office is the final point from the beginning to end of control of AFSC.

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At some point, there must be a decision as to when control of the weapon shifts from the developer and builder to the operator. In the case of the Titan 1 squadron, whose control center is here at Lowry AFB, external pressures dictated location of a special launch site as early as possible.

Col. Julius Pataff, wing commander, has the responsibility for managing and operating the squadron. He has been caught between the external factors that force him to do what he does and the fact that this responsibility should be spread as much as possible at an early stage.

They are so divided, but the outcome of taking over before full test status has been reached has caused some internal division. These aspects are considered to be in a growing pains, however.

The 45th Strategic Missile Wing is made up of two launch squadrons, a maintenance squadron and a headquarters squadron section.

The 45th Missile Maintenance Squadron, commanded by Lt. Col. R. D. Lupton, is responsible for maintaining the missiles, the associated support equipment and the security of the facilities from the beginning to end of control of AFSC.

Lt. Col. C. F. Middle, who commands the Wing Headquarters Squadron Section, is responsible for all administrative functions of the personnel assigned to the wing headquarters.

The 724th and 725th Strategic Missile Squadrons commanded by Col. W. K. Gilbert and Col. C. V. Holmes, are the combat elements of the wing.

The weapon system which Col. Pataff must bring in full combat status and keep them in combat status. All of the personnel personnel are responsible for their combat status, as is the maintenance force that determines the ultimate reliability of the weapon. Presently the wing is located at Lowry, at the eastern edge of Denver. Personnel are housed and fed there and all supply services located there.

Specialized agricultural planes to the east are the complaint which nags up the squadron. Both squadron is composed of three three-squadron complexes, each one of which is a complete, self-sufficient control and launching installation. There are three sites, each last stage removed, the entire site can be, with no adverse class qualities for the after effects, a power loss and emergency landing. All are underground.

A single, exterior, through dugouts



Missile or meteor?

GM tracks down the answer!

FROM GM'S DEFENSE RESEARCH LABORATORY: In DRL's unique Flight Physics Department, studies are now in progress on hyper velocity projectiles. Projectiles travel as fast as 33,000 feet per second through DRL's light gas gun. It is expected that speeds up to 40,000 feet per second will soon be attained. These studies provide clues to new missile detection methods and instruments which will identify the distinctive signatures of missiles and meteors. They will prove in seconds which they are and where they came from.



Two Light Gas Guns used light gas projectiles to produce velocities of supersonic projectiles of metal, glass, and ceramic at distances and velocities. If you are interested like these contact DRL.

General Motors Defense Research Laboratories, Santa Barbara, California • **Aerospace Operations** • **Sea Operations** • **Land Operations** • **Biological Operations** • **Technical Operations**



Research and Development in the national interest

to last for 50 days without outside contact. This includes 130,000 gal. of diesel oil to generate power. The power house contains four diesel generators, two of which are large on the last at all times. One other is in standby status and another is in maintenance status.

A system of tunnels connects the elements of the complex. A main passageway and means of gaining free ventilation provides fresh air. To accomplish this the tunnels are built on a fairly remarkable plan, so that air can flow from mountain towers to crystal pits where the main heat is generated. The heated air rises to the surface in ducts, augmenting the natural flow. Only the power house has its own private ventilation system.

Guidance Antennas

The longest stretch of parapetted roadway is 1,250 feet. In the area of the base complex there is the main communications tower. There are two elements of the system that provide command radio guidance. If these two should be destroyed in an attack, antenna from an other complex could take over the guidance task.

Each missile in its site is kept loaded with RPM fuel. To prepare for flight, an interlocking loading system is used to load the missile with liquid oxygen. The total countdown time for Titan I is 15 min. First the liquid oxygen is loaded and the interlocked gaseous system is placed on final ignition. The doors over the missile are closed, the valves are opened, and the missile is boosted to the surface on an elevator. It is then ready for firing.

One each night in the Titan I development program involved a practice run of this sequence of a site and control complex at Vandenberg AFB, Calif., in December, 1960. The site had been running practice runs for some weeks, preparing batteries on each until there was enough fueling and lifting of the missile to the surface.

Site Destroyed

At the time of this accident, the countdown had gone to zero and the rat was called off. The procedure then was to lower the capsule onto the site and detonate it. When the cleat detonator was pressed, however, instead of lowering gradually, the elevator and capsule plunged to the bottom. Not only was there the RP-1 and liquid oxygen on the missile, but more stored in tanks in the site. The sparks and ignition of tanks led to a full explosion which literally demolished the site and most of the plumbing units in the surrounding concrete. As a result, a new site had to be constructed.

Heart of the complex is the control

area, located 50 ft. below ground. The control room itself contains three general cameras, each scanned by an oscillator with a switch speed of 30 mils per frame.

The missile combat area contains an airlock as a separate room behind heavy doors.

Two radars are also on the center to provide maintenance for the complex equipment.

Each one, which stands a 24 ft. post of dark steel posts to base, is made up of the following:

One missile combat area commander, one guidance control officer, one missile system architect, two missile mechanics, one maintenance technician, one missile system planner, one refrigeration equipment cooling operator, two missile electrical troubleshooters, and two electrical power production operators.

If an accident occurs beyond the capabilities of the crew, help can be obtained from Loring. Other backup facilities available include two mobile field engineering personnel.

Complexes are located here 10 to 12 mi. apart so that no single missile weapon could knock out more than one complex.

Guided missile resources are given 28 courses which are conducted at three Air Training Command bases. Most are given at Sheppard AFB, Wichita Falls, Tex., with others at Charlotte AFB, Tenn., and at Loring.

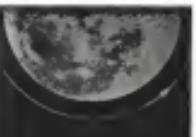
Vandenberg Training

The first team training for the Titan I crew is now at the 307th Air Division Squadron of the 1st Aerospace Division at Vandenberg AFB. Each man, according to his job, training in individual skills and needs to be trained in teamwork.

The Strategic Air Command actually began planning for the selection and training of combat missile crews and support personnel in 1955. Previous SAC experience in planning its people personnel for bombers had shown that a lead time of 8 to 12 years was accurate.

This rather lengthy page has quickly, but far the Titan I lead time has proved to be 4 to 6 years, the same as for the Atlas ICBMs. The Moonbeam lead time will be even less. This is the result of conservatism in development and production.

SAC had no background in planning what kind of men to assign to the new missile status. During World War II experience had been accumulated in the handling and maintenance of major weapons, for instance. High quality personnel were required in maintenance areas, especially after jet aircraft became the norm, along with complex electronic equipment associated with the guidance and bombing systems. The



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FINANCIAL

Spacecraft, F4H Programs Point To New McDonnell Sales Records

By James D. Hardwick

New York—Government expenditures planned for the Mercury and Gemini manned spacecraft programs and the F4H Phantom strike aircraft would be the new sales streak on which the next three years for McDonnell Aircraft Corp. according to Thomas P. Rehfeld, vice president and controller.

Reporting a backlog of about \$115 million as of May 14, 1962, Rehfeld told a recent meeting of the New York Society of Security Analysts that McDonnell's new program for the Mercury, Gemini and Phantom programs are signed up. In Sept. 30, McDonnell will offer a revised backlog.

Rehfeld told the analysts his own sales expects good sales and profits through at least the next four years, for two more reasons:

• F4H, already operational with the Navy and scheduled for Air Force use under the F-110 designation, will be the dominant U.S. strike aircraft during the next four to five years.

• McDonnell is the only U.S. company with a operational aircraft space vehicle and the world should hold that advantage for at least another three years, Rehfeld said.

National Aerospace and Space Administration contracts awarded to McDonnell for the Project Mercury space craft total about \$145 million to Dec. 31, the company official said, and McDonnell will not caught up in road, that on par with last summer, 1961. First and most Mercury one-man spacecraft will be built for NASA's projected 15-orbit flight, and these vehicles will be capable of use in training future astronauts for space flight or for unannounced space research flights.

General Work

Thus, last year no determination yet as to the ultimate size of our Gemini work, but it should develop into at least double the dollar volume of our Mercury work, Rehfeld said. "The present requirement is for 17 Gemini two-man spacecraft, each of which will weigh two to three times as much as the Mercury one-man vehicle, have 50% more cabin floor of cabin volume and be capable of orbital flights of a week or longer."

Rehfeld stressed that McDonnell's experience in design, construction and flight testing of single-seat aircraft

for USAF's Project ASSET (Methane-methane Structural Systems) has great potential and will lead into excellent lines of future business."

Commenting on the F4H, Rehfeld said that first outside the company, is covered in advance award of \$1.7 million for engineering and tooling now under way for the F-110. "I think there is a high probability that the first aircraft for a production version—the F-110A will be signed in the second quarter, January, February," Rehfeld said. "Final 1963 budget provides for over 250 F-110s and 20 RF-110s."

Funds for these aircraft total about \$880 million, and over 60% will be accounted for McDonnell contracts, Rehfeld said. The contracts will be scheduled for negotiation next month and are due to be signed by September. USAF and Navy have planned to fund all three variants of the Phantom in their F-4C/H/D/E budget. Rehfeld said the same is true. He added that McDonnell is exploring the possibility of selling F-4B to the Air Force or all other North Atlantic Treaty Organization nations.

Financial Status

Describing the company's financial status, Rehfeld said the expected sharp swing upward in earnings is not reflected in results achieved during the same month ended May 31. Sales increased to approximately \$188 million, 7.1% higher than the comparable 1961 period. Net earnings rose 9.7% to slightly more than \$10 million, says for the comparable period in the company's latest quarterly report. Earnings \$1.96 compared with \$1.68 for the same last year. The first and the last quarter of the current fiscal year should add about \$1.00 per share, Rehfeld said.

The company is free of any debts, and working capital has increased a small of more than \$60 million, he added.

While attributing the major credit for this progress to the spacecraft and F4H programs, Rehfeld pointed out that other areas have had off for the company, citing:

• **Quail drone missile.** Delivery to the Air Force will end next month, but spares, modification and support business should continue for at least two more years.

• **Telemaneuver.** Contracts to date for the

CRYOGENICS Refrigerator- Liquefiers



At the present time CRYENCO is leading the hydrogen refrigeration business. The company's experience with liquid hydrogen refrigeration equipment has had major responsibilities for production of five of the six largest hydrogen refrigeration plants designed for satellite launches in the last four years. Experience on these refrigeration equipment in raising record numbers of 100-degree Celsius between the standard and space vehicles on experimental vehicles in 1961 as well as bubble chamber supercooled liquid hydrogen accumulators. Products of related areas include magnetic levitation, high pressure gases, liquid helium, refrigerated dryers, low temperature chambers, ortho-para-purity catalyst, etc. For your physical and engineering needs for liquid-hydrogen storage or CRYENCO engineers design and build your custom equipment meeting your exact requirements. Write Company for full details on these low temperature high vacuum capabilities and experience.

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surface-to-air Navy system's software and integrated naval flight regime would be more than \$64 million, and such work should commence far ahead of plan. Development of the Typhon, an improved version of the Tides, could push the business beyond Fiscal 1996, Radcliffe added.

• **Assault rounds.** Contract work is under way with the Army on a sophisticated heavy battlefield missile, Barfedge said. Other work in aerosol/solvent missile development could pay off for the company in the new future, according to Barfedge.

• **Autism and Asperger's.** These disorders will develop more than 50%

action in business this year, Rutherford said. The Electronics Equipment Division, established in January, 1961, has more than 60 stores in production and 38 equipment programs under development in guidance and control.

Texas Instruments Officials Vote First Cash Dividend Since 1953

Dallas, Tex-Tenn Instruments, Inc., declared recently the last cash dividend as its common stock since the share were listed on the New York Stock Exchange in 1953. At the annual meeting of TTI's board in Dallas, dividends were to total quarterly dividends of 20 cents per share of common stock. June 1 is the record date. The company has 3,945,475 shares of common stock outstanding.

The company had indicated in its prospectus that it planned to place book earnings into expansion and research programs and to keep common stock cash dividends permanent. J. E. Jacobs, T1 board chairman, on announcing the new dividend policy, indicated that the company's strong financial condition permitted permanent dividends although research and development and engineering expenditures will continue at a high level. The company has been under some pressure to make such a policy a permanent one.

1961. In reporting first quarter earnings for the current year, Hargrave stated that earnings after taxes were \$2,411,000, equal to 60 cents per share on sales of \$3,483,000. Net earnings were \$3,775,000 or 95 cents per share on sales of \$5,977,000 for the same period last year. He noted that fourth quarter 1961 net earnings totaled \$2,148,000 or 58 cents per share on sales of \$3,260,000. This resulted in net profits of approximately \$9.6 million on

sales of \$270.2 million in 1961. During competitive pressure Haggerty noted that last year TT shipped more than 40% more physical products than in 1960 for practically the same sales dollars and with less than 5% increase in cost. In the first quarter of 1962, TT's physical volume across the company was 15% higher.

卷之三

Since a larger proportion firms used of TIEs last quarter strongly this year reflect even more optimistic results where lower tax rates prevail, the overall tax rate was more favorable than before and profit after taxes in the first quarter registered a return of 4.2% on sales.

Highlights of 11 current specimens mentioned by Haggerty include the following:

- **Shrike** New anti-surface record (AW May 17, p. 321), for which TL is

*Sales in earth sciences, including solid earth physics, geophysics, oceanography and space sciences, has shown an increase in the number of participants.

men in whom sales of more than \$1 million annually have been made from 18 to 1958 to 41 last year.

■ A new series of microcomputers with built-in tape and disk drives, the Micro/80, has been announced by TTI. The new series is based on the 6809 microprocessor and includes the 8000, 8010, 8020, 8030, 8040, 8050, 8060, 8070, and 8080 models. The 8000 is a single-board computer with 16K bytes of memory, a 16K byte ROM, and a 16K byte EPROM. The 8010 is a single-board computer with 16K bytes of memory, a 16K byte ROM, and a 16K byte EPROM. The 8020 is a single-board computer with 16K bytes of memory, a 16K byte ROM, and a 16K byte EPROM. The 8030 is a single-board computer with 16K bytes of memory, a 16K byte ROM, and a 16K byte EPROM. The 8040 is a single-board computer with 16K bytes of memory, a 16K byte ROM, and a 16K byte EPROM. The 8050 is a single-board computer with 16K bytes of memory, a 16K byte ROM, and a 16K byte EPROM. The 8060 is a single-board computer with 16K bytes of memory, a 16K byte ROM, and a 16K byte EPROM. The 8070 is a single-board computer with 16K bytes of memory, a 16K byte ROM, and a 16K byte EPROM. The 8080 is a single-board computer with 16K bytes of memory, a 16K byte ROM, and a 16K byte EPROM.

BAC Reports Profit On Merged Operations

London-British Aircraft Corp. made a 1961 profit of \$4.5 million on sales of about \$30 million. Morphet, a retired Royal Air Force Lord Portal of Hungerford, RAC chairman, told stockholders recently:

Total sales amounted to \$225 million, the \$50 million on which the program is based saw new projects that since British Aircraft Corp. was formed by merger BAC include the aerial and ground warfare activities of British Aircraft, English Electric Aviation, Vickers-Armstrongs (Avro), and Hunting Aircraft.

Referring to the weapons business, Lord Portal revealed formation of joint BAC/Fairchild Engineering Co firm to develop what he called "certain projects." Wings invited to the Farnborough air show, weapons, as it was pointed out in Aviation Week (AW 11/13).

The corporation now has \$784 million on its order books. In a program to expand, Lord Portof pointed out the following:

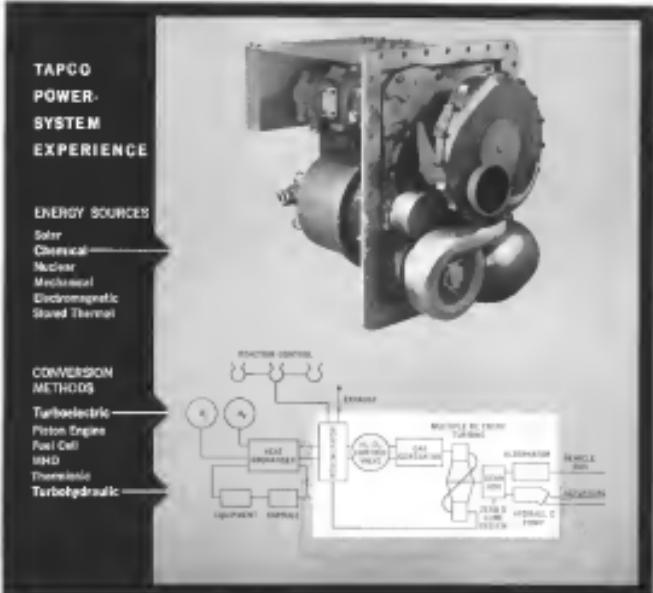
- Considerable portion of BAC design and development capability is being taken up by the TSR 2 strike aircraft for the Royal Air Force, through a joint Vickers-English Electric design joint
- Delivery of English Electric T-45 aircraft Lightning jets for RAF have been completed
- 14 aircraft have been completed
- First flight research aircraft, the BIP 10, being built at Filton under Ministry of Aviation contract, is well advanced and will fly this year.

- Extension of BAC variable geometry container (AW Apr 9, p 26) is under discussion with the Ministry and Loral. Potential confidential Aviation Work is in parts that the concept is part of a past Dassault-BAC Mirage IV design for the North Atlantic Treaty Organization's ATACRE programme.

Lord Portal said a total of 53 orders has been written off on private contracts, including development of the BAC 111 twin-jet transport. He said a total of 26 orders has been placed, including eight with an airline which does not wish to be named.



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HE'S REDUCING THE COST OF AN ENGINE OVERHAUL

It is customary for overhaul shops to use a vapor blast to clean the baked-on carbon from turbine engine blades and discs. This is a slow process. The material to be removed resembles a very rough varnish. Every bit must be removed from the surface of the metal so any cracks present will be easily visible. But slurry covers up the work, the operator works blind, the danger of eroding the metal beyond maximum limits is great.

Airwork looked for a better way—and found it in the dry-blast used in an allied industry. This proved to be not only faster—but gave the operator a constant, un-

obstructed view of the work. The result: less chance of metal erosion—and a better inspectable surface that makes metal flaws easier to spot.

This is one result of our constant effort to reduce costs while increasing reliability. It saves many labor dollars on a Dart engine overhaul...and will soon be saving money on piston engine overhauls, too.

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BUSINESS FLYING



FOTZI HENKEL, CM-191. Here's probably the first time at Hanover Air Show, a firm place (right) to view and know aircraft developed by French West German industrial team. Aircraft is powered by two Turbomeca/Mitsubishi 6-turbine engines developing 1,050 lb. static thrust each. At Hanover, government permitted only two 30-min. flights per day with pilot and visual pilot or mechanic aboard.

Hanover Features CM-191 Demonstration

By Herbert J. Calmann

HANOVER—Peter Henkels' CM-191 is a four-place executive jet (FAW Age 25 p. 107) was shown publicly for the first time last week at the Hanover Air Show. Europe's answer to the Boeing

Customer demonstration, however, was severely hampered by a German pilot fulfilling the request to fly the CM-191 with more than two persons aboard. The pilot, a 100-hour passenger holding a commercial pilot's certificate, was flying the aircraft during its testing. Other passengers on that first CM-191 had only 10 hr flight time and this was an experimental plane.

In addition the CM-191 was limited to two 30-min. flights per day. Third was a small press interview planned as the show's after jet, a Lockheed Jetstar, flew in Hanover by Jacqueline Cochran.

In the helicopter field, emphasis displayed were the Potez 540 (FAW Age 25 1968 p. 20) and the Sloane Marquis (p. 147). Second Potez 540 will have two seats with a flat floor which allows it to go over high fields up to 4,000 ft. long for takeoff and landing.

• **Canadair** is making transonic with a transonic aircraft in the eight, featuring the same airfoil chord section to eight times

the chord length of the aircraft.

• **North American** (North American and Rotor Flapco) recently, it tested out the sonic air-warrior experiments. Four strakes could monitor 100 in the radar.

• Navigation and radar trailer which could be used along with a ground data link for training pilots who are converting to larger jet transports.

and will make an first flight on Aug. 16. One exterior change has been made by adding 3 in. to the vertical fin for increased area and stability. The company and dealers will start at the end of 1968 initial deliveries will be 90 planes.

Military Version

The software version has been altered to the Royal Air Force on the basis of a projected 90-seat order and that Royal Air Force is assessing a similar version to West Germany. The first flight will be made with Lockheed F-104G evaluation.

• Military versions envisioned for the aircraft include:

• Hospital-ambulance jet fitted with an stretcher and two seats, stressing 100 ft. 125 rough-field capabilities and operating characteristics which allow it to go over high fields up to 4,000 ft. long for takeoff and landing.

• Gunship or missile transport with a television camera in the eight, featuring the same airfoil chord section to eight times

the chord length of the aircraft.

• **North American** (North American and Rotor Flapco) recently, it tested out the sonic air-warrior experiments. Four strakes could monitor 100 in the radar.

• Navigation and radar trailer which could be used along with a ground data link for training pilots who are con-

verting to larger jet transports. Britain's Boulton Paul Co. will be at with production problems as an 106 executive twin, did not show the plane at Hanover, although one had been built. The first production aircraft has been modified by lengthening the wingspan to 42 ft and increasing cabin size to present width of 42 in. and height of 12 in.

• Crosswind category was shown in the British Avro Tucano 2, presented due to the British pilot regulation. In mid-June, the British made such a flight to the Mach 2 demonstration. All three named planes because of the British policy of acting as explorers only their dealer and service facilities have been set up in the countries visited.

U-18 Appearance

Joining the line of American business aircraft for the first time was the U.S. though 104 analogies, not making a strong around Europe and Southeastern nations to generate interest for future sales. Jim Cope of Proctor Corp., the who is representing Unicraft on the firm, and the European distributor will be the firm of Friendel College.

• **Pratt & Whitney** delivered data to European customers have not been worked out, pending final arrangements for production in Florida.

(For other detailed coverage of Int'l week's Hanover Air Show, including European design studies presented there for the first time see p. 56.)



AERONCA . . . and the 15-minute* man!

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Без Пенс, кандидат лиге выходит на сцену: К.Р. в финальном матче избирает Европу, чтобы уйти от не-европейской Европы, Родинской Европы.



NAME: **BAILEY, THOMAS** (1914-1988) ADDRESS: 323 122, **WINDSOR** ON, N0B 1L0, **canadian** **citizen** **born** 10 dec 1914 **deceased** 1988 **cause** **old** **age** **place** **WINDSOR** **ONTARIO** **canada**

German Jet Aimed at Business, Airline Use

Hamburg-Hanover Fliegergeschwader's planned entry into the already-crowded exercise jet arena, the HFB 320, is being gauged for potential military and feeder-line markets, with a tentative first flight date and subsequent entry date for the 6-to-14-place aircraft set for the second half of 1984.

Hoppe's to expand its own operations" but, just at the same time, broaden the scope of the West German aviation industry as a whole, the case goes on to appear the spending of private funds for production of private trials and endurance flight tests testing. Construction of a full-scale fully-capped mockup is nearing completion and detail design is well under way.

The aircraft to be powered by two 1,000-hp Pratt & Whitney R-1340-6 radial engines of 1,000 lb-thrust each (AV Apr 21 p 185) equipped with three-blade propellers designed to fit the external appearance of a number of other, although generally smaller, proposals already submitted with a significant difference—the wing, with a span of 45 ft 10 in and an area of 635 sq ft, is 13 in. for

Forward or negative sweep is such
as has been under study by the National
Aeronautics and Space Administration
for a number of years and, according
to reports here, promises some definite
economic advantages over conventional
aircraft. Its principal drawback, and one

It has made U.S. manufacturers anxious of its adoption, if the need for exceptional strength in order to handle a bullet and gun loads, it would cost extra in this configuration.

3.2.2. *La softa*

Blasberger: Pengonghan, however, suggests that this wing exhibits no particular design features and will provide a number of benefits, including full-time effectiveness over the entire range.

A major reason behind the decision to adopt forward sweep was the desire to position the passenger and luggage compartments completely forward of the engine in order to avoid passing passengers through the cabin, who would be occupying the rear seats.

Hamburger HFB.320 Specifications

	Sea Plane	Runway Plane
Wing span	45 ft. 11 in.	45 ft. 10 in.
Length	50 ft. 10 in.	53 ft. 30 in.
Height	13 ft. 7 in.	13 ft. 3 in.
Empty weight	8,756 lb.	8,705 lb.
Fuel and oil	5,746 lb.	4,794 lb.
Gross	19,507 lb.	19,777 lb.
Propulsion	850 h.p.	1,415 h.p.
Useful load	7,225 lb.	7,525 lb.
Takeoff weight	30,531 lb.	36,814 lb.
Com. speed	96 mph	97.5 mph
Kompa (sustained)	1,001 mi	793 mi
Takeoff distance (over 50 ft.)	2,565 ft.	2,750 ft.
Landing distance	3,881 ft.	3,650 ft.



This special photograph was taken during the existence of the first man-made satellite, Sputnik. It was taken from the deck of the aircraft carrier *Midway* and is page 100 of *Space Year Book*.

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3. A specialized electronics research staff has been established in the Los Angeles area, to serve Air Force missile activities on the West Coast.
4. Hallicrafters is participating in a new R & D and manufacturing facility to be built in Chicago, for high-power microwave tubes and vacuum devices.

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- Electronic Counter-Measures equipment systems for bomber and fighter aircraft, missiles and rockets, ECM reconnaissance systems, ECM simulators.
- Radio Frequency Interference measurement and reduction; components.
- "Blue Flash" Project (field, electronic testbed support)
- And of course, many other classified programs.

*The original photo was taken by President John F. Kennedy February 20, 1962, at his request over Wernher von Braun's television. John F. Kennedy, Jr., took it from.



HALICRAFTERS — Creates a more self-sufficient standard with a precision stable signal in the 400 mc. region. It is part of the present instrumentation for the Atlas missile program.



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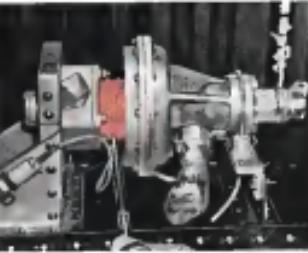
AEROSPACE DIVISION
CHICAGO 34, ILLINOIS

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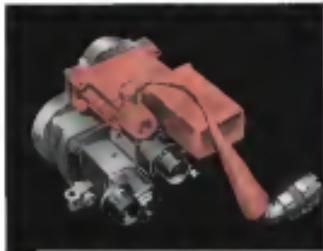
GENERAL ELECTRIC RTV SILICONE RUBBER KEEPS THE PRESSURE IN THE X-15!



Critical pressurized areas of the X-15, designed and built by North American Aviation through a joint NASA Air Force/Navy aerospace project, are sealed with General Electric RTV (room temperature vulcanizing) silicone rubber. After being applied to the surfaces to be sealed, the RTV cures at room temperature, forming a flexible seal that is capable of withstanding the extreme operating or loading stresses caused at altitudes of 100,000 feet or more. RTV is also used to seal the fuel tank behind the cockpit, instrument compartment and shielding near the ship's midsection.



RTV exclusive seals lasting lifetime for extreme pressure requirements. RTV rubber forms tenacious bonds to most materials provided surfaces are properly prepared and easily cleaned. Non-vulcanizing RTV is also available. It can be applied to the surfaces of an aircraft or other vehicle, then cured at room temperature or operating or loading stresses caused at altitudes of 100,000 feet or more. RTV can be cured from room temperature to hours depending on catalyst used and heat if applied.



Protection against hydrogen peroxide corrosion is provided by RTV silicone rubber coating on this valve assembly. Because RTV is commonly used to protect against moisture and many chemicals, it's used in almost all U.S. missiles and space vehicles, not only for sealing, but for electronic sealing and encapsulating, and as thermal insulation. It insulates electrical properties with physical protection.

If you would like a free sample for evaluation, write or wire us for literature, describing your application. Section 256, silicone products department, General Electric Co., Waterford, N.Y.

TYPICAL PROPERTIES OF RTV SILICONE RUBBER

	RTV-111	RTV-301	RTV-401	RTV-501	RTV-601	RTV-701	RTV-801	RTV-901	RTV-101
Viscosity (Poises)									
Color	White								
Adhesives									
Adhesive Type	Flexible								
Temperature Range	-40° to +250° F. (+40° to +120° C.)	-40° to +250° F. (+40° to +120° C.)	-40° to +250° F. (+40° to +120° C.)	-40° to +250° F. (+40° to +120° C.)	-40° to +250° F. (+40° to +120° C.)	-40° to +250° F. (+40° to +120° C.)	-40° to +250° F. (+40° to +120° C.)	-40° to +250° F. (+40° to +120° C.)	-40° to +250° F. (+40° to +120° C.)
Strengths									
Strengths	110	200	250	350	400	500	700	1000	1400
Strengths (lb/inch)	1.18	1.20	1.47	1.55	1.67	1.87	2.18	2.67	3.47
Adhesive Properties									
Adhesive Strength	100	100	100	100	100	100	100	100	100
Adhesive Strength (lb/inch)	1.18	1.20	1.47	1.55	1.67	1.87	2.18	2.67	3.47
Volume Resistivity									
Volume Resistivity (ohm-cm)	10 ¹²								
Volume Resistivity (ohm-cm)	10 ¹²								

A wide range of RTV compounds meet a variety of application requirements. Low viscosity RTV-11 (or transparent RTV-601) is used for sealing electronic assemblies and coil insulations. RTV-21, 30 and 50 are mainly used for high-temperature sealing and for thermal insulating and adhesive applications. Intermediate viscosity meet other insulating and sealing requirements. Intermediate viscosity meet other insulating and sealing requirements.

GENERAL ELECTRIC



TOP-VIEW of Balsinger Flugzeug 90-120 shows pressurized forward areas of the wings, along with relatively high 11 ft and narrow 9 ft front wings under each side of fuselage. Tip tanks are mounted on the German aircraft's wing centerline.

inadequate in view of the proposed test which the aircraft will be put to.

"As the wing is placed behind the passenger cabin, it must be slightly forward. This is not so much to increase the critical Mach number as to bring the center of gravity low near the center of lift. Flying wing aircraft, the relatively short wing span engender, as well as the small radius of sweep and the thin shell construction of the wing, the Lanchester distances of this type of construction do not severely affect the aerodynamic stability of the aircraft. Just the opposite, it will produce a very good, fast, stable, good and excellent control about the point of control shift." These characteristics should prove to be of considerable advantage in an aircraft designed for the purpose of the FBS-120.

Design purpose of the aircraft is defined by Balsinger Flugzeugbau to be to top the "upper end" of the extreme air transport business" and the leisure flight market. It also could be

NOW ADVANCED DESIGN SOLID STATE POWER SUPPLIES

This custom-built, solid state, combined audio and digital power supply for Polaroid is typical of equipment now being developed both military and industrial users. Output powers from milliwatts to several watts. Continuous and pulsed waveforms are available from various sine wave oscillators.



PS-50 DIGITAL POWER SUPPLY

Continuous Ratings		
Output	Output Power	Output
PS-50	50W	100W
PS-100	100W	200W
PS-200	200W	400W

Vibration: 10-55 Hz 0.05G²/Hz^{0.5}
PS-50: 10-15 Hz 140 MILS 370-002
PS-100: 10-15 Hz 140 MILS 370-002
PS-200: 10-15 Hz 140 MILS 370-002

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BRING AN
IMMEDIATE
QUOTE**

DRESSER ELECTRONICS



there's a ship on the way to the moon

There will be many mission steps, but every shot in the Atlantic Missile Range puts the U.S. closer to its goal of a lunar landing in this decade.

Some key capabilities on the range will be sharply increased in Mobile Alertant Range Stations—large transports being converted to ongoing laboratories under Sperry system management—go into service.

Sponsored by the Manned Test Center of Air Force Systems Command, these

MARS ships will incorporate every advanced technology of data acquisition and handling, integrated communications, radar, telemetry, inertial navigation, weather forecasting. Able to go anywhere in thousands of miles of ocean, they will provide for refined study of space vehicles during the critical return phase of flight.

The MARS ships will help fulfill AMR's responsibility with NASA for range instrumentation supporting our

exploration of space. And the capabilities developed will be steadily advanced in pace with the program. Team members with Sperry include Battelle, Shipbuilding, Ford Instrument, Gehr A Co., ITT, and Remington Rand UNIVAC.

SPERRY



MARS SYSTEM MANAGEMENT GROUP, SPERRY SPINACER CO., DIVISION OF SPERRY RAND CORP., GREAT NECK, N.Y.

adopted for orbiting use, as a VIP trans port and navigation center. The report, a compact study document, "is to prove that such a specialized, reliable and navigational equipment of larger aircraft has also to offer a trans port version's modified passenger plane for regular service." It adds:

"Research showed that the operating costs of such an aircraft would be higher than those of a machine with maximum passenger capacity. It was found, however, that prices would not be out of proportion to normal air fares, particularly when it is considered that the flight duration is higher with smaller planes."

As a feeder liner, the result could be considered to cost 12 passengers in 9 seats at a rate of three passengers per seat rate of the full load. As in an intercity airship using the eight-plus a man forward facing seats for three, their overall crew complement would earn a pilot and co-pilot.

Maximum Range

Maximum range for this version would be 750 mi with maximum, so far as for a 100 mi diversion flight plus a full-hour holding with 5% of the total fuel supply remaining upon landing. Cruise speed is quoted at 99 mph. Direct operating cost at full load with 12 passengers and 2 crew aboard is estimated at 4 cents per mile over a 100 mi nonstop flight.

In another configuration, three larger Passenger Airships have divided cabin sections, plus providing for a lot of first class passengers plus two crew in the most spacious layout to a high of nine passengers, plus accommodations three on a six seat. Maximum range for the simpler version, with much easier to those computed for the longer load, would be 3,491 mi at a lower cruise speed of 191 mph.

Tower facilities in both the airship and seaplane versions are housed on the left side of the fuselage just behind the crew compartment and forward of the cabin doors.

An announcement of planned plans for the HB 120 marked the second recent new entry into the marketplace with passenger numbers transported. The two new projects—the HB 120 and Fairey's (English) Mariner 20, a project follow-on to the seaplane Comiso single-pilot the number of programs in this category under way is planned to range and the United Kingdom to at least 10, all aimed towards weight the same market area.

It also marked the second announcement in more weeks of plans by a West German firm to make a hole in the cell wall of a field that has been lagging behind thus far as a result of the located practice facilities coupled with the drive to rebuild that nation's



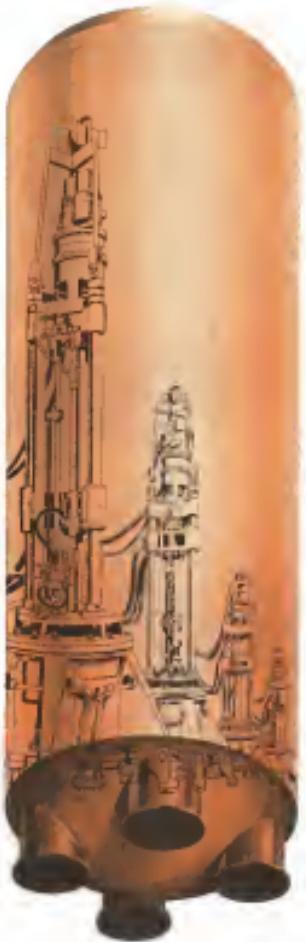
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Almost half a century of successful experience in the development of oxygen breathing systems in the fields of medicine and aviation gives Puritan's unique state of the art in designing, engineering, testing, and manufacturing components for oxygen breathing systems.

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HAND IN HAND

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... New MARVAC (Marevac) steels by Latrobe. Failure of a component in a missile or jet aircraft can mean failure for the entire system. That's why optimum performance in high strength structural applications and critical tooling calls for alloys possessing the ultimate in quality.

The newest concept in ultra high strength metals is the manganese steels developed by International Nickel and being produced by Latrobe Steel under the trademarks *Marsac-18*, *Marsac-18A*, and *Marsac-20*. These low carbon manganese base alloys contain 18 to 20 percent nickel plus important alloying additions. Besides their unusually high strength and toughness they show remarkable ductility under extremely high stress concentration, far superior to 18-11 and 4340 types.

Produced by the consumable electrode vacuum melting process, hardened by aging at 900°F., *Marsac* steels offer:

- Tensile and yield strengths in excess of 280,000 psi.
- Notched tensile strength over 400,000 psi.
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- High fracture toughness at all temperatures down to minus 330°F.
- Simplified heat treatment with a minimum of distortion.
- Excellent weldability and machinability.
- Unusually low work-hardening characteristics.
- Good workability, both hot and cold.

Let your Latrobe sales representative show you how *Marsac* can work for you. Or call the mill direct.



LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

defense forces in line with the others of the North Atlantic Treaty Organization. Earlier, Ernst Heinkel Flugzeugwerke revealed plans to develop private short-haul airline services with two aircraft, one a turboprop and the other a turboprop (AW Apr 10, p. 45).

Both programs also stem from a 1958 instruction by the Ministry of Economics requesting West German firms to develop plans for and arrange the Heinkel transports as soon as follows: to complete submitted at that time, the HFB 320 as an offshore Ministry hopes of financing the more promising projects submitted during the competition failed to materialize, but both firms continued their development work in the field.

Heinkel Flugzeugwerke originally had planned to enter the medium-range airliner market with a 70 passenger Mach .8 design designated the HFB 314, but, as other aircraft appeared in the competitive scene and Federal funds being remained elusive, it was never built. The end result was the HFB 320.

Competitive Position

Although competition here also promises to be stiff, the German firm says it is "convinced" that the ultimate demand for such an aircraft will make the program worthwhile.

The HFB 320, it adds, will be capable of carrying "any load that could be safely taken by a transoceanic in one day." It is also particularly suitable for charter to tourists. It can be used for freight service, as an airbus or high frequency service, as a small cargo jet, or, in a smaller or as a multi-purpose military aircraft.

To power its cabin as a cargo carrier, the forward passenger entrance is being designed with dimensions of 34 in. by 27 in. The inboard main cycle landing gear will be equipped with low-pressure tires to prevent tire runout operation.

The passenger cabin within the rear main fuselage contains forward and rear baggage compartments that are accessible in flight. The escape, passenger cabin and luggage holds are pressurized to provide a constant internal pressure of 5,000 ft. at a flight altitude of 30,000 ft. Minimum cabin width is 4.2 ft., standing height is 5.5 ft.

Maximum fuel load is 6,745 lb. stored internally in the wings and in two 10 cu. ft. tanks that will be provided as standard equipment. Biplane surfaces, supplying a normal pressure of 2,957 psi, operate the landing gear, flap system and ailerons. External power is provided by the nose prop, side and rear rudders which is supplied by two 20 hp alternators.



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NAVION RANGERMASTER FOR 1982 retains basic Navion configuration, but achieves distinctive look by addition of continuous tip marks and indistinct colors. Dual fin rudder design concept. Engines are 200 hp. Continental IO-470-H.

Aviation Week Pilot Report

Modifications, More Power, Give New Life

By William S. Reed

Long Beach, Calif.—Extensive modifications and increased power added to the basic Navion aircraft of the same basic previous year has resulted in a fast, easy handling light aircraft with more fuel for long range and a normal cruising range of 1,475 mi.

Production of the 1982 Rangermaster by Navion Aircraft Co. of Gardena, Calif., spans new life for the original American Avionics aircraft that was produced by American Avionics until 1952. Basic design and structure of the Rangermaster retains the Navion wing, landing gear and basic fuselage surface but beyond that, the aircraft has undergone major changes.

Performance has been increased by the installation of a Continental IO-470-H-16 cylinder, fuel injection engine developing 200 hp and featuring a McCauley constant speed hydraulic propeller. The Rangermaster's range is 1,475 mi at 7,500 ft on 65% power and the aircraft has a maximum air speed of 198 mph at maximum continuous power.

The Navion Rangermaster is largely



NEW INSTRUMENT LAYOUT places fuel gauges and timer switch on overhead panel.



DOOR CUTOUT extends probably into cabin roof. Sliding and cutout is stepped flap provides steps to wing.

to Navion

now aerodynamically cleaner than an overhead or mock of an old aircraft. The familiar sliding canopy covering a large pilot cabin has been fused over and a large cutout door placed on the left side. One step up and one cutout is placed in the flap in steps. Flaps have been raised to allow them to be used in steps.

Included in the base price of \$32,500 is exterior paint in a variety of colors, interior trim and upholstery, full instrument panel night lighting and a dual instrument panel. Options can be purchased at extra cost for the Rangermaster. The aircraft is built by Avionics Week at Western Navion, Inc., West Coast distributor, was equipped with Mooney ADF, VHF, and audio equipment, bringing the price of the craft to \$24,500 complete. (Avionics at an extra cost of most of the features offered as options to other manufacturers allows marketing of the Rangermaster.) Western Navion's general manager, Dan Cambell, said light aircraft have the factor of a low listed price but when the customer adds up the options needed to make the aircraft mobile, the price often is \$5,000 more than the base price.



HYDRAULIC GEAR design incorporates passive release system for fast fail gear lowering.

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When fire detection is an afterthought, everybody pays: builder, operator, and passenger. False alarms, redesign "fixes" and general inconvenience have given this vital safety system a bad name. Why?

Too often fire detection is an afterthought. The engineer must "fix it" — rather than "design it." If you make us in early enough, our

systems are chosen without knowing how they will perform. Components are located where they do little good — or are inherently subject to damage. But this need not be.

Here at Fenwal we've grown up with aircraft fire detection. We've equipped hundreds of planes, and worked with every major layout. If you make us in early enough, our

experience can improve your detection system. Because only Fenwal has a complete line of proven detection equipment, we can give you absolute objectivity and recommendations based on a solid experience foundation. Just call us for more information. Fenwal Incorporated, 126 Pleasant Street, Ashland, Massachusetts.

Fenwal

Rangefinder, in most cases, has a lower delivered power than similarly equipped competing aircraft despite a starting quotation which may be higher.

The Rangefinder still retains the familiar Navistar look, the main power source of which is located in the rear fuselage. Encapsulating sections of the aircraft are proportionally smaller than those of most light aircraft because of the distance from wing to tail. The rudder on the Rangefinder has been modified to include an aerodynamic counterbalance at the top which reduces rudder pedal forces considerably.

Tip Tanks

The centrally mounted tip tanks make the Rangefinder readily distinguishable from earlier Navistar aircraft. Each tank holds 34 gal. and is located 18 inches from each tank to the engine. A selector valve connects both tanks to each tip tank, as well as the main tanks of two wing tanks, is equipped with a fuel gauge. Tip tank fuel is not used for landing or takeoff and a plenum state that fuel from the tip tanks is to be used in level flight only.

Extruding into the cockpit is a fairing mounted from the left side by a large section extending partially into the rest of the cabin. There are no options on other aircraft appointments except for color, but quality appears to conform with the typical "go-faster" label of light aircraft. Individual arm and headrests are supplied and each seat is equipped with individual reading lights and armrests similar to those found in automobile seats.

Overhead Panel

Electrical switches, fuel gauges and master switch are located on an overhead panel leaving the main panel free from clutter. Throttle, propeller control and fuel pressure control—the latter replaces a mixture control on fuel-in piston engines—all are remote operated. A button on the panel allows the mix ratio to be disengaged, whereupon a



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3. The thermostatic-type CECO valve is used on experimental jet aircraft to control the flow of air in cooling air-braking systems.
4. A "patented" CECO fuel control and pumping system used on the Roton Q-1C target missile.

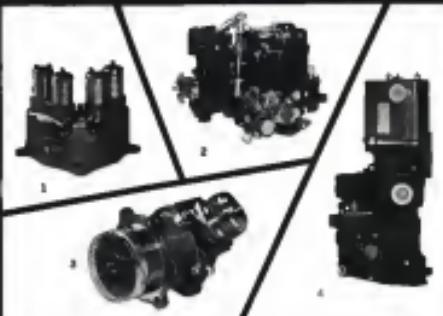
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Los Angeles Operates Fire Helicopter

Bell 47-GIB helicopter owned by Los Angeles County Fire Department has been fitted with 100 gal tank to enable it to "haul" blazes with high degree of accuracy.

push with the heel of the hand permits them to be advanced rapidly. Advancing or retarding any of the three blades must be done by rotating the blades and while this is acceptable for open and fuel pressure control, thrust, operation period considerations for this pitch, cage calls for caution.

Thrust is accomplished through a steerable nose wheel linked to the rear outer pedal and the rudder pedal linked uniquely to drop down or extend by a going right being down. Variables at ground for all ground operations.

Control during the takeoff was easily maintained withudder pedal applying a combination of nose wheel steering and rudder. No sharp transition was observed as the nose wheel leaves the ground. Climbout is made at 100 mph, 145 with 25 in manifold pressure and 2,500 rpm. Initial rate of climb observed was in excess of 1,200 fpm at a gross weight of 3,000 lbs.

Over-the-nose visibility is not necessarily compromised during climb in the Bell helicopter because of the steep climb angle. The view from the front of the windshield, visibility to the side is somewhat limited by the cabin roof but not so much as in a high-wing aircraft.

Landing gear and flap on the Roton master operate hydraulically, and once the aircraft is lowered up after takeoff pressure on the hydraulic system is relieved by bleeding in the hydraulic power tank. Excessive hydraulic fluid temperature and the loss of fluid should a leak occur thereby are eliminated. A valve system is employed as the Roton American T-6 with the exception

that the power button returns to the off position on a nose gear down. In case of hydraulic failure in the Neuron, a hydraulic system disconnect is used to relieve pressure on the landing gear retraction cylinder and the gear free-falls into the down-locked position. In release of the uplock, a check pump is installed to lower flap in the event the down-flap fails. Failure is sensed by a float pump.

Climbing speed was checked by level flight at the 3,000 ft. mark, and allowing the aircraft to stabilize with the power set at 24 in and 2,400 rpm. Total pressure is set at the desired value according to the gauge, a flow rate of 9 psi for 50% power. Inhibited air spent was 100 ft/min at 3,000 rpm, which figured out to 17.1 mph was averaged.

Afterburner free speed of the Roton master for normal cruise is 150 mph at 7,500 ft. Fuel consumption at this setting is 12.1 gal/hr. Although not tested on America's West's best endurance record, 90% power at 12,000 ft. was 2,400 rpm and 16.1 mph afterburner power. This should yield 177 mph TAS with fuel consumption of 9.8 gal/hr and 1,658 air range.

Very minute power settings are also possible with the vernier controls, maintain on fuel pressure which greatly affects range. Use of recommended fuel pressure settings shown on the page will eliminate the possibility of burned valves from low fuel pressure or even reverse fuel consumption from too rich a mixture.

The Roton master exhibits good landing qualities in all normal modes



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July 2, 1962

Today's most timely aerospace industry subject—the National Aeronautics and Space Administration—will be featured in AVIATION WEEK & SPACE TECHNOLOGY's July 2, 1962 issue.

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5. New procurement policies

... as well as a longrange forecast of NASA's future in our industry.

How to do business with the fastest expanding part of the aerospace market, scheduled to award contracts exceeding Three Billion Dollars in fiscal

1963 is a subject that will command the attention of key leading influences and open the door to massive sales opportunities for thousands of manufacturers throughout the nation. As an example, in the Mercury project alone over 4,000 subcontractors participated. The NASA man-in-space program is projected toward a \$20 to \$30 billion total over the next decade.

AVIATION WEEK & SPACE TECHNOLOGY has achieved an international reputation for presentations of this type with the Systems Command Issue, "Forging Military Spacepower" (1961); the Strategic Air Command Issue, "SAC in Transition" (1960); the NASA Issue, "Next Decade at Space"

(1959); and the Air Research and Development Command Issue, "Research for Space" (1958). Teams of AVIATION WEEK & SPACE TECHNOLOGY editors are now carrying out assignments covering NASA operations and losses throughout the nation. We urge your company's participation by advertising its products, capabilities and facilities in the most important aerospace issue of 1962.

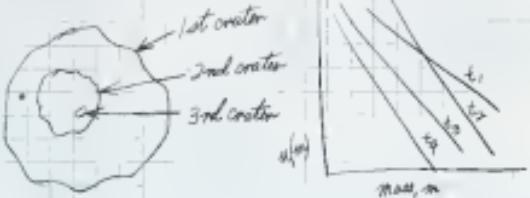
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of interest to engineers and scientists



LUNAR SURFACE RESEARCH

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This Douglas study seeks to increase man's understanding of the character of the moon's surface and how it will react to space-exploring machines and man.

Theoretical investigations are being supplemented by experiments in the Douglas Space Physics Laboratory. Here the effects of high vacuum on simulated properties of the surface of the moon are being studied to deduce the best model for the lunar surface that satisfies existing data. Moon crater formation is also under study to determine whether volcanic processes are in action.

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Douglas has entered into a period of greatly expanded activities in a number of programs (like the above) which relate to tomorrow's

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use. Speed stability and maneuvering stability are both positive but not to an extent which becomes a manner. Considerable mass can be possible at cruise speed without the use of fuel to move a center of a control elevator between roll and pitch, but this system is not powerful enough to stabilize with uncommanded maneuver when in flight.

Stalls are double with simple warning stemming from aerodynamic buffet. This holds true for both the pitch and roll landing configurations. Aerodynamic effectiveness is obtained by pitch moments as a result of heat distribution on the wings which causes the root to stall first.

Low Gear Level

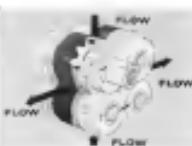
Normal level within the cabin is low for an aircraft of this class. Normal conversion is easily carried out and the radio loadpack can be used in lieu of headphones without danger of dislodging or causing radio interference.

Trip tank fuel is used once the main tank is depleted to 10 gal, thereby using the dual purpose of returning a heavier load on the wings in the event of shutdown and also providing fuel economy in the event of landing. Considerable fuel is returned to the main tank from the fuel injector which can reduce the amount of fuel needed and return the excess portion to the main. Operating on trip tank fuel depletes the secondary tank as well as effectively transferring fuel to the main. Eight wing locations

will occur at trip fuel level and both this can be overcome by keeping the trip within 35 mm fuel consumption of each other.

Cruise speed is in the range of 130 mph. Economy cruise is at 130 mph within 3 to 4 sec. The tractive portion can be flown safely at 110 to 120 mph with the propeller slowed to 105 mph as the final run. Fly on economy is stated below 105 mph and for most normal landing, one-half to three-quarters flap can be used with an approach speed of 90 mph. Should full flap be used, the final flap rate can be increased to 15 mph but care must be exercised in flaring out because the approach angle is very steep. Normal landing roll is 1,000 ft. but the landing roll can be reduced to 750 ft.

It is possible under some conditions to overload the Rangemaster because of the large cabin capacity. Total load must be less than maximum when five people are carried since the maximum gross weight of 3,815 lb. could be exceeded. It is well also to note that if half is off loaded to allow the main mass payload to be carried, it is much easier fuel that is overflown. The main mass can tolerate load for the weight of 1,000 lb. when the fuel is carried over about 300 lb. of payload as is just over the cabin, an amount of fuel equal to the excess weight must be left out of the main fuel tanks. In all cases it is advisable to fill the trip tanks so that the fuel weight replaces a flying load on the wings.



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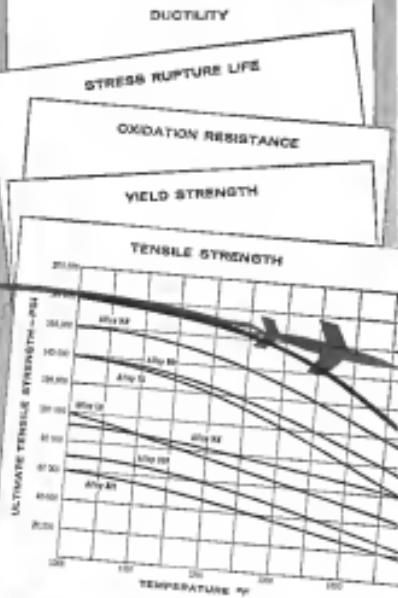
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For complete details, write for Technical bulletin No. 86.

*Used on NASA Reference Rocket



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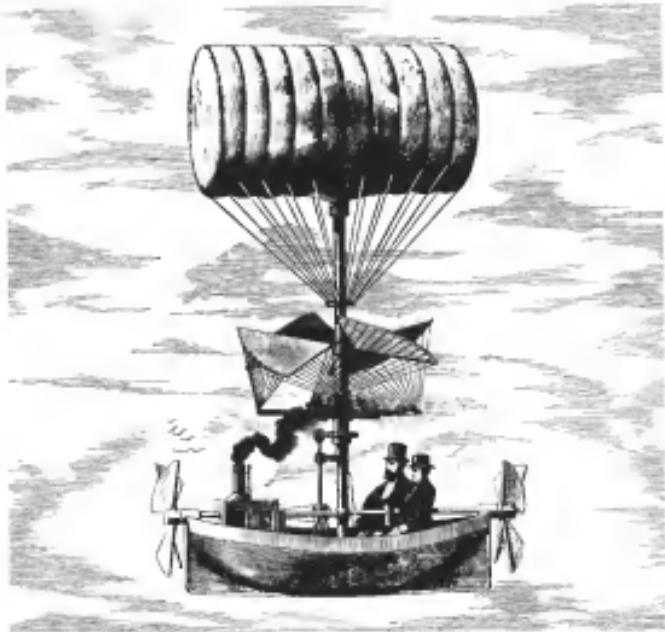
METALLURGICAL SPECIALISTS



Sferma Marquis, Brantly B-2 Shown at Shakleton

First Short B-2 delivered to English (above) is shown at much-anticipated British Executive Aviation Services' display at the massive Shaktola International Business Flying Show at Stevenage, August 10-12. The B-2 made several takeoffs and landings from the close-quarters helipad at Stevenage. Below, Sferma Marquis, turboprop-powered version of the British Bureau of Aircraft Enquiry's Marquis, is displayed. Data sheet of the aircraft is in the United Kingdom at Short Bros. & Harland, Belfast. Aircraft and Testers Mk. 1 were the only British products at the display. Also over the years were the Helio Courier short takeoff and landing aircraft shown at the Shaktola show by MacLaren Aviation, Ltd. Below is a Cessna 172 conversion was shown at the show for the first time by its agents, Rango Aviation, Ltd.





It looked good on paper, but...

...this 19th-Century concept of aerial navigation machine by H. Badley was doomed to failure.

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Lightplane Industry Queried on Collusion

Lead-off question in the Department of Justice Anti Trust Division's often-voiced investigation of the U.S. aircraft and aircraft parts industry was held by James Aircraft Corp. during hearings opened in Wichita, Kan., recently by a special grand jury.

Top Reisch management and sales executives, two of the company's debt-holders and dealers and aircraft owners and operators from which scattered see-saws of the industry were called before the special 12-man panel, to question by three Justice Department vice-presidents.

The panel was formed from the just concluding four industry witnesses left at the time of the session indicated that the department's strategy was to develop sufficient evidence against one manufacturer to provide a test case from which the department might move against the rest of the industry.

Hearings opened here last week marked the second phase of the Justice Department's investigation of the industry.

Special grand jury last year subpoenaed documentation from eight buyers and eight aircraft manufacturers as to their distribution and sales practices, distributor/dealer operations, interests dating back to 1946 pertaining to industry meetings at which representatives of the companies present gave confidential reports (AW Mar. 19, 1961, p. 2).

Department of justice representatives also are known to have taken depositions from a number of dealers and customers regarding experience in sales of aircraft.

Indications are that the major issue of questioning opened by the department's Anti Trust Division representatives are aimed at determining the following:

- If conspiracy or acts of collusion are involved in sales and promotion activities of the industry generally, including the aircraft and aircraft parts manufacturers.
- Basis of distribution agreement, "lock-up" planning and whether the firms carry undue influence on the sales or distribution of equipment to aircraft.
- Philosophy of distributor/dealer free choice and protected sales territories.
- Whether there is exchange of information between the manufacturers regarding production and delivery schedules.

The jury is empowered to hear testimony and decide if there are grounds for formal charges on the basis of antitrust violations. Indications are that the second phase of the hearing might be concluded this week and narrowed until further sessions this fall.

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Said Hans Gerskedt: "When a conductor carries current through a magnetic field at right angles to it, the resultant reaction thrusts the conductor in a direction perpendicular to both the current and the magnetic field."

A light-weight, low-fuel-consuming propulsion system is a primary requirement for interplanetary space vehicle travel. One such system now being carefully studied utilizes plasma propulsion.

This concept employs an electrical field to produce a plasma and to energize it. A magnetic field then ejects the plasma, thereby providing a reactive thrust to the vehicle.

Plasma propulsion is but one of many subjects under investigation at Lockheed Missiles & Space Company. Outstanding facilities, equipment and scientific personnel make the organization uniquely capable of exploring many unusual aspects of space travel. This, coupled with Lockheed's facilities locations in Sunnyvale and Palo Alto on the beautiful San-Francisco Peninsula, consistently attracts scientists and engineers interested in pioneering work in their special fields.

Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. R-26A, 999 Market Avenue, Sunnyvale, California. An Equal Opportunity Employer.

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BILL 47-52 drops slingshot at great cuts made while boring at high altitude. Right is cable heliport parked on rock.

Helicopters Aid Tramway Construction



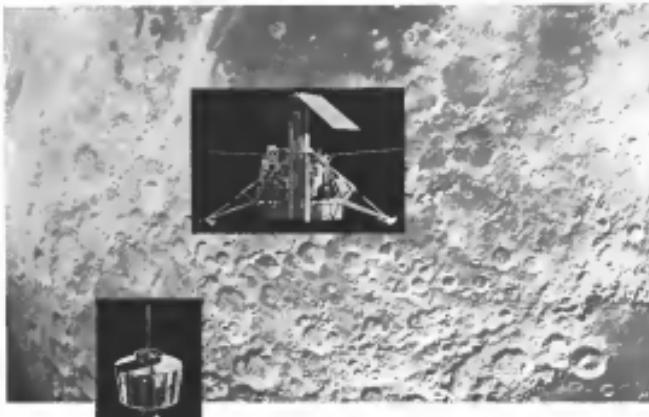
Flight of light helicopters is being better than 50 round trips daily moving men and equipment to a elevation 8,500 ft above sea level to aid in construction of a tourist attraction on the face of a primitive mountain that is inaccessible by conventional vehicles.

Mountain is to build a \$7.5 million aerial cable car tramway that will climb nearly 6,000 ft during a thousand-half-mile ascent to the east face of Mt. San Jacinto overlooking Southern California's Palm Springs. Passengers will ride from the desert to a new room in 83-passenger stainless steel cars.

Since mid-September, Bill 47-52 and 47-53 of United Helicopters, Inc., San Francisco, making the 20-mile flight up and down the steep face, have laid out, paved, water, bulldozers, tractors, metal building material, stores, refrigerators, food, before, diesel fuel, generators, lumber, steel and personnel to the construction site. During the first five months, the helicopter flew 1,180 tons of material.

At the heliport, one heliport has been built 600 ft from the ground for loading and unloading cargo and personnel. Union Oil Co. has provided a 5,000-gal tank to store fueling.

Each helicopter averages about three round trips per hour. In addition to supplying men and material to the remote, rugged site, the aircraft are also utilized to move massive tower sections being hoisted into and anchored onto the face of the steep cliff. Helicopters are being lowered to the side of the cliff at tower bases to facilitate their starting after the tramway becomes operational.



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NEW AEROSPACE PRODUCTS

De-Icing Tester

An instrument, developed to check the de-icing liquid on the Convair CL-44 transport aircraft, has an accuracy of 10% and provides 100 lb. force at an air to water pressure ratio of 10:1. At about ambient temperature, the unit factors into:



The unit is attached to a tank mounted gas turbine compressor for power source. Compressed bleed air is furnished with two air pumps and a heat exchanger. The manufacturer claims that the unit also is suited to ground testing and passes tests in Boeing 727 and Douglas DC-8 jet aircraft.

Vulca Corp., Torrance, Calif.

Airborne Hydraulics Pump

New AP-100 Series pump accepts a broad variable volume feature. Its application to aircraft, missile, fluid power and ground support equipment



Manufacturer says the pump will deliver up to 100 gpm at 5,000 rpm, and 1,000 rpm with a maximum displacement of 0.96 cu. in. per revolution. The single-stage, air-cooled unit has a pressure compensator valve to regulate volume according to motor demand to meet pre-determined pressure requirements.

The unit weighs 64 lb. and offers fast response and high power-to-weight ratio, the manufacturer claims.

Kellogg Division, American Brake Shoe Co., 1102 W. 38 St., Omaha, Calif.



Lex Tank Purge System

Mobile air system is designed for purging mobile liquid oxygen tanks to prevent internal staining after liquidation.

Model GE-100 system consists of an air line compressor, filter, accumulator and expansion valve. It delivers three sizes of -196°F dewpoint air at 50 psig.

The air is filtered to eliminate any contaminant particles that are larger than 10 microns.

Krebs Equipment Corp., Coopersburg, N.Y.



Temperature Control Valve

Automatic device extracts self-contained and requires no external power, automatically mixes hot and cold in cooling fluids and operates a flow of oil at constant temperature.

Unit is designed to operate in an open, hermetically sealed jacket. Gasket face temperature is maintained at the valve to maintain a 7° gear ratio at 40°.

Valve operates on ambient temperature and can handle up to 100 gpm at 5,000 rpm, and 1,000 rpm with a maximum displacement of 0.96 cu. in. per revolution. The single-stage, air-cooled unit has a pressure compensator valve to regulate volume according to motor demand to meet pre-determined pressure requirements.

The unit weighs 64 lb. and offers fast response and high power-to-weight ratio, the manufacturer claims.

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Please complete this form and forward to: Mr. D. F. Waters, Professional Placement, Dept. 62, McDonnell Aircraft, St. Louis 66, Missouri. This is not an application for employment. Your qualifications will be reviewed by our placement staff and you will be advised of positions at McDonnell for which you qualify. You may then make application if you wish. All replies confidential.

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Department CG-5, Cyclops Controls Corp., East Amherst, N.Y.



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Savannah Branch, Librascope Division, General Precision, Inc., 670 Aquatic Ave., Sunnyvale, Calif.

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New device was developed to vaporize any liquid fuel, can be connected to any conventional or industrial power source without intermediate transfer or switching equipment, and savings in space from portable models (\$3,000 cu. ft. of gas per hour) to large units (10,000 cu. ft. of gas per hour) are savings in cost.

Missileers save the expense of public transportation equipment, with an increase up to one secondary heat transfer fluid required. Overall heat transfer coefficient is reportedly 1,800 btu/hr/ft² at 60 deg. F. Device also eliminates external heat tubing and provides more space for other deep, continuous thermal efficiency and maximum space refrigeration, the manufacturer reports.

Cal-Vac Research and Development Corp., 1941 West 39th Street, Woodland Hills, Calif.

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WHO'S WHERE

(Continued from page 21)

Honors and Elections

Dr. Arnold C. Dean, professorships, at the University of California in Los Angeles, has been elected to the National Academy of Engineering. Dr. Lawrence J. Lazzarini, South Model for test stand instrumentation in the investigation of aircraft, today.

Changes

Dr. Gerald M. Minami, program director, laser systems, Martin Co.'s Space Systems Division, Baltimore, Md.

Dr. Raymond Herring, director, Space Sciences Laboratory, Western Development Division, Phillips Co., Colorado Springs, Colo., Colorado, a member of the Faculty of the Co.

Dr. Walter F. Grundahl, director of research, Vought Division, Northrop Corp., Von Neumann, Calif.

Mr. Gen. F. H. Baker (USAF, ret.), program manager Project MTR, Allentown, Pa.

Col. John F. Fink, USAF, head of the 1000 Flight Inspection and Procedural Division, Federal Aviation Agency, Flight Standards Service.

Walter L. Prichard, head of fire investigation and rescue squad support management, National Fire Protection Association, Lexington, Mass.

Robert M. Whithorn, chief engineer, RJ Systems Division, Radiation of State, Oak Park, Ill., a member of the Radiation Protection Committee.

Howard F. Thomas, manager of Sperry Gyroscopic Co. in Wethersfield, Conn., elected to the Board of Directors of the Minneapolis Register Co., Minneapolis, Minn., and Donald H. Whisenant, director of customer relations, John Womack Aircraft Co., Dallas, a member of marketing for the company.

Dr. Ernest J. Schubert, manager, Broken Racket Systems for the Systems Division, Rockwell International, Inc., Pasadena, Calif.

H. W. Shadley, general manager, Minuteman Division, The Boeing Co., Seattle, Wash.

Dr. John J. Myles, director of engineering, Sander Bond Electronics Systems, North American Aviation, Columbus, Ohio, dies, 1962.

Thomas A. Holloman and Louis M. Thompson, heads of the Air Materiel Corp.'s new Technical Systems Department, Bedford, Mass. Also Boston Airtex manager, Strategic Systems Department.

Robert F. Hender, managership and sales, Dynacor Corp., Reading, Pa., Robert F. Hender, Robert W. Hender & Associates, Mr. Hender, a sales and operations director, Research B-17 and B-177 programs, Wichita.

Edgar H. Hunkel, engineering manager, Head Station Maintenance Division of Crane Co., Parkersburg, W. Va.

Hugh C. Banta, machine designer, Advanced Division, East, Inc., Santa Monica, James E. Knoblauch, manager, and Robert C. Haudinger, engineering manager, Goddard Range and Range Rate System, Motorola's Military Electronics Division, Santa Barbara, Calif.

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PROBLEMATICAL RECREATIONS 118



Using the French Tricolor as a model, how many flags are possible with five available colors if two adjacent rows must not be colored the same?

—Continued

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ANSWER TO LAST WEEK'S PUZZLER: If we assume B is telling the truth, then by following the implication of his statement we find that D is also telling the truth. If we assume B is lying, we find that C and E are telling the truth. In either event, however, A is lying. Thus A is the only suspect we have with certainty to be lying.

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